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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Development Organisations

Mr. W. R. Barclay was able to explore a new subject in his recent Presidential address to the Institute of Metals, and one of which he has special knowledge, the growth of what he called development organisations. This was illustrated with particular reference to four non-ferrous metals, nickel, aluminium, copper and tin. They may be said to have their origin in the modern development of scientific selling. The time has long since passed when the average user was content to purchase from the older type of representative or salesman, who to-day must be prepared to supply and talk confidently about technical details. These organisations collect and supply such details, and in this way they have performed a real service. They are naturally easiest to form where the commodity concerned is produced by a small number of manufacturers, but by co-operative working they are spreading to fields which a very few years ago would have been regarded as unpromising. On the purely advertising side, in fact, the Press and the hoardings offer many illustrations of such co-operative action, whether it be the sale of transport, electricity, gas, beer, paint or coal.

The development organisations referred to above, however, go further. They are staffed by scientifically-trained men, and they promote research and investigation, which in general, with great wisdom, they arrange to be carried out by impartial bodies, thereby demonstrating their own impartiality. Modern salesmanship must, in fact, in the long run be based on the truth. The metallurgy of cast iron owes no small part of its development to these activities, and it may be noted in passing that, although the industry has had for some years before it the admirable example set by these development organisations, it lacks any such development body of its own. However, in spite of many handicaps, those bodies serving a development function are spreading the use of cast metals among engineers and other users. The main difficulty, of course, is the multitude of producers who appear to see no common ground for action. An American effort to conduct propaganda on behalf of grey iron does not appear to have survived the depression, although they have somewhat analogous bodies for other cast metals.

Selling to the Dominions

No one is more appreciative than ourselves of the laudable efforts made by the British Dominions to provide themselves with a metallurgical industry, even though they require a certain amount of tariff manipulation to make them self-supporting. This has been recognised as right and proper under the Ottawa Agreements. At the same time it was understood that for ancillary activities, that is, where the demand rules out local supply, then preference should be accorded to imperial manufacturers. The last Dominion to envisage the creation of a large steelworks is New Zealand, where a £3,000,000 State-aided establishment is under consideration. The smallness of the population and the absence of any industry except rail transport which could absorb large quantities of steel makes the chance of its economic exploitation extremely doubtful. The major requirements are probably, in a farming community, barbed wire and galvanised sheets, and these are readily available on the international market at prices which only extremely large-scale production could emulate. Ireland is gradually building up a live foundry industry, but up to now there is no very serious talk of introducing a large-scale steel industry. The case of South Africa is different, for in addition to the great railway system, the mining industry is highly developed and is capable of consuming large quantities of steel, of a standardised character, whilst the agricultural industry is expanding. These industrial developments need all the help they can get from the United Kingdom, such as the provision of rolls, dies, wortle plates, moulding machinery, conveyors, machine tools, furnaces, and all those things which market conditions, coupled with a desire for the latest and best available, indicate that local supply is likely to be inadequate. The facilities for reaching Dominion markets have never been better and United Kingdom manufacturers of specialties have indeed a golden opportunity. We are cognisant of the difficulties to be associated with the marketing of specialties, as the demand is, by its very nature, intermittent, and individual representation is ruled out by travelling expenses. Yet these conditions are the same for the foreigner, and inquiries will be received by the more enterprising concerns whose names are well known without a traveller necessarily calling at their door.

British Iron and Steel Federation

ANNUAL DINNER IN LONDON

Sir Austen Chamberlain was the chief guest at the annual dinner of the British Iron and Steel Federation at Grosvenor House on March 19. Mr. A. K. McCosh, the President, was in the chair.

In submitting the toast of "The Iron and Steel Industry," SIR AUSTEN CHAMBERLAIN congratulated the Federation on the advance which it had made during the past year. The output, he believed, had been doubled in that period and unemployment was little more than one-third of what it was three years ago. Their industry was essential to our national life, and to our defences. The iron and steel trade had justified the increase in the tariff made last year because it had been used to effect international agreement which was vital to our own industry at home and equally beneficial to all the countries which were party to it. The Federation was representative of trades vital to the defence of the country, and after the alarums and excursions of the past few months the requirements of the country should be placed in their proper position. He believed that their great association, imbued with public spirit, would not seek to take any undue advantage of the needs of the Government, and that they would be careful to disturb as little as possible world trade which they had laboriously built up since the dislocation of the war.

A Reasonable Profit

The PRESIDENT, in reply, said he took exception to the ill-informed statements, all too common, about the inordinate profits made by their industry through expenditure on armaments. Most of the large firms engaged in the industry, far from making enormous profits as a result of the great war, had since then, and largely through their efforts during the war, to undergo drastic reconstruction, at enormous cost to their unfortunate proprietors. It would not be too much to say that an undue proportion of the cost of the war fell on the shoulders of their industry. They did not claim that they should make more than a reasonable profit, but they did maintain that they were entitled to make a profit and to provide adequate depreciation and obsolescence reserves from such work as they were called upon to do.

LORD DUDLEY proposed the toast of "Our Guests," and MR. M. E. DENNY, President of the Shipbuilding Employers' Federation, replied. The toast of "The President" was submitted by LORD MAY.

Among those present, prominent in the foundry industry, were:—Mr. W. R. Barclay (President, Institute of Metals); Mr. H. H. Berresford; Mr. H. Brearley; Mr. D. F. Campbell; Sir H. Carpenter (President, Iron and Steel Institute); Mr. J. Craig; Commander Sir Chas. Craven; Mr. H. W. Crawford; Mr. V. Delport; Dr. C. H. Desch (National Physical Laboratory); Mr. W. C. Devereux; Mr. W. E. Dobson; Mr. V. C. Faulkner (Editor, THE FOUNDRY TRADE JOURNAL); Mr. C. W. Fellows; Mr. E. J. Fox; Mr. E. J. George; Mr. W. T. Griffiths, Dr. W. H. Hatfield; Mr. K. Headlam-Morley (Secretary, Iron and Steel Institute); Mr. F. J. Hemming; Mr. P. B. Henshaw; Capt. R. S. Hilton; Mr. J. E. Hurst (President, Institute of British Foundrymen); Mr. H. Jeans (Chairman, THE FOUNDRY TRADE JOURNAL); Sir F. Joseph; Mr. B. B. Kent; Mr. J. S. Kerr; Sir W. J. Larke; Mr. S. C. E. Lloyd; Mr. H. W. Lockwood (Hon. Secretary, London Branch of the Institute of British Foundrymen); Mr. W. R. Long; Mr. G. T. Lunt (President, Foundry Equipment and Supplies Association); Dr. A. M'Cance; Mr. A. N. McQuistan; Sir H. Mensforth; Sir F. Mills; Mr. L. G. Monfort; Mr. J. G. Pearce (Director, British Cast Iron Research Association); Mr. W. F. Prentice; Mr. W. Reavell (President, British Engineers' Association); Mr. A. S. Shirlaw; Sir S. Roberts (Master Cutler of Sheffield); Dr. T. Swinden; Mr. B. Walmsley; Mr. A. S. Ward; Mr. J. Ward; Mr. F. Wardrobe; and Mr. A. Young.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Sulphur Loss in Standard Drillings

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—We notice Mr. T. E. Rooney's letter printed in your issue of March 12 regarding the determination of sulphur in steel by the evolution method.

As makers of standard analysed samples of steel, we have watched this question for a number of years, and in our experience we have not found it practicable to store turnings for several years, even in sealed dry containers from which the oxygen has been largely removed, without some risk of the yield of sulphur as hydrogen sulphide diminishing.

This led us, some months ago, to prepare standard steels specially for the determination of sulphur by the evolution method. This involved the issue of fresh turnings at intervals of not more than one year and packing them in air-tight bottles containing a desiccating agent. This procedure proved to be much more acceptable to chemists than endeavouring to obtain the true sulphur content from old drillings by heating in a reducing atmosphere.—Yours, etc.,

N. D. RIDSDALE,
Director.

Bureau of Analysed Samples,
Limited,
3, Wilson Street,
Middlesbrough.
March 17, 1936.

Book Review

The Structure of Metals and Alloys. By William Hume-Rothery. (Institute of Metals Monograph and Report Series, No. 1.) London: The Institute of Metals, 36, Victoria Street, S.W.1. (Cloth, 3s. 6d. net, post free.)

The Institute of Metals has commenced the issue of a series of Reports and Monographs relating to metallurgy, of which the first monograph—"The Structure of Metals and Alloys"—is by Dr. Hume-Rothery. This book is a treatise on physical metallurgy, without higher-mathematical treatment, and is therefore to be recommended to those whose concepts of the physical universe are not governed by wave-mechanics and thermodynamics. The book contains sections on the electronic background of metallurgy, the crystal structure of the elements, atomic radii of the elements, primary metallic solid solutions, intermediate phases in alloy systems, and imperfections in crystals. Each chapter is provided with a bibliography of selected references, while an adequate index is provided.

Oxygen Estimation in Steel

A new vacuum furnace and its application for the estimation of oxygen in steel by the hot-extraction method are described by G. THANHEISER and E. BRAUNS in Report No. 288 of the Mitteilungen aus dem Kaiser-Wilhelm-Institut für Eisenforschung zu Düsseldorf. This furnace possesses various desirable features in design and operation, making it suitable also for the estimation of other gases present in steel. In the application of the furnace described by the authors, it was found that the effect of the manganese content of the samples analysed on oxygen estimation was very marked, being to a very large extent determined by the working conditions, particularly the rate of cooling.

Institute of British Foundrymen

GLASGOW CONFERENCE

As previously announced, the Annual Conference of the Institute of British Foundrymen will be held in Scotland from June 9 to June 12, under the Presidency of Mr. H. Winterton. The programme is provisionally arranged as follows:—

Tuesday, June 9.—The Conference Office will be opened in the Grosvenor Restaurant, Gordon Street, Glasgow.

Meetings of Committees and General Council and Annual General Meeting of the Institute will be held in the Grosvenor Restaurant.

In the evening there will be a Civic Reception by the Lord Provost and Corporation of the City of Glasgow.

Wednesday, June 10.—At the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow, there will be an Official Welcome by the Lord Provost of Glasgow, Sir James Lithgow, Sir Arthur Huddleston and Colonel Kennedy. The Presidental Address and Technical Sessions will occupy the morning until 12.45 p.m. The ladies will participate in a motor tour to Largs and the whole of Clydeside.

Members and ladies will lunch together in the Grosvenor Restaurant.

There are to be works visits during the afternoon, followed by dancing.

The Annual Banquet will be held in the Grosvenor Restaurant.

Thursday, June 11.—Leave Glasgow at 9.20 a.m. by special train for Edinburgh. Technical Sessions in Edinburgh until 1 p.m.

The ladies of the party are to visit Holyrood and other places of historic interest.

Luncheon is by invitation of Scottish Branch.

During the afternoon a number of visits have been arranged.

Civic Reception and Tea offered by Lord Provost and Corporation of Edinburgh in the City Chambers.

6 p.m., the party returns to Glasgow by special restaurant train and a meal will be served during the journey.

8 p.m., the annual Edward Williams Lecture will be given by Prof. A. L. Mellanby in the Engineers' Institute, Elmbank Crescent.

8 p.m., the entertainment for the ladies will be announced later.

Friday, June 12.—9.30 a.m., leave Glasgow by new L.M.S. steamer "Marchioness of Graham," which has been specially chartered to take members and their ladies for a sail down the river to Tail of the Bank, Cowal, Rothesay, Kyles of Bute, Arran, Cumbraes and Gourock. Returning by special train, arriving in Glasgow at 7.30 p.m. Luncheon and tea will be served aboard the steamer.

Hotel Accommodation

Members intending to be present at the Conference are advised to book accommodation early as there is another large conference and several minor meetings being held in Glasgow at the same time.

Little-Known Cause of Corrosion.

A little-known cause of corrosion in water heaters is described by L. W. HAASE and G. GAD in "Gesundheits-Ingenieur." In galvanised or plain-iron water-heaters, where the metal is in contact with copper or copper alloys, traces of copper are deposited on the iron or galvanising as a result of contact action. Local cells are thus produced which lead to a deterioration of the zinc coating, even in the absence of oxygen. This action may be combated by galvanising all copper parts, or removing the dissolved oxygen.

Coreshop Cost Reduction*

By NOEL P. NEWMAN (Director, Newman, Hender & Company, Limited)

In the preparation of this short Paper it is intended to deal with the subject of coreshop cost reduction more from the general commercial aspect rather than the technical. Naturally, the cost of core production varies considerably in relation to the class of trade and more particularly between the mass production of cores as against smaller-quantity jobbing. This Paper applies largely to the mass-production type of business where a large output is required at a minimum cost.

Under the subject of "coreshop cost reduction" it is proposed to divide this Paper under the following headings:—(1) Material; (2) labour, and (3) overheads.

MATERIAL

"Material" is composed of two most important items—sand and bonding materials. With a view to reducing cost it is desirable to standardise on one coresand mixture as far as is practicable and to keep special mixings down to a minimum, and thus save considerable time and cost in mixing, handling and coremaking.

Experience in the production of large quantities of both small and medium-sized ferrous and non-ferrous castings has proved that one coresand mixture, with the exception of a mixture for machine-blown cores, will cover all requirements and give uniformly good results. One coresand mixture covering such requirements is that of nine parts Mansfield or equal red sand; 26 parts silica sand, and four parts used sand bonded with two parts of a proprietary semi-solid core compound.

The storage of supplies of new sand should receive careful consideration, as often a little time and thought expended on the initial lay-out can save considerable expense at a later date in handling. Naturally, the storage of sand should be as near as possible to the sand-preparing department, preferably kept in either steel or brick bunkers, and so arranged that sand can be discharged into them either by tipping lorry alongside or, where ground levels permit, by drop-bottom bogies from overhead. From the storage bunkers the sand can be fed to the mixing machines either by means of a short bucket elevator or in a fixed-capacity container by power hoist.

In the case of silica sand, which is usually dried, the storage bunker of new sand should be alongside the drying plant. An ideal arrangement for dealing with the dried sand is to elevate it from the discharge of drier by means of a small bucket elevator into a primary steel bunker for cooling purposes and from thence discharge into a secondary bunker ready for actual use.

Bonding Materials

With regard to bonding materials, it is important that the standard of quality is maintained and the composition is uniform, and for this reason it can be fairly argued that for the average foundry, which may not have the assistance of a laboratory and chemists, the use of a bonding material manufactured by specialists and sold to the trade generally is preferable to the making of a bonding material in the foundry itself. There is no doubt that one of the largest savings in core cost is dependable upon the quality of the oil binder, namely, that green cores should retain their shape without the aid of any packing or shells and in addition should in most cases be strong enough to stand in the green-bond condition and thus save considerable handling and storage space during the drying process. In addition, when properly dried and baked the core should not be susceptible to moisture. From the foregoing it will be appreciated that an initial increase in the cost of bonding material may more than be saved by a reduction in cost of coremaking, handling or drying.

Reclamation of Old Sand

A further saving is possible in the cost of coresand mixture by the judicial use of old used or unused coresand. Certainly all spilled and unused sand from the coreshop should be returned daily to the sand-preparing department and, if properly screened and milled, can be used in new mixings. In addition, all unburned cores from the casting shake-out can be returned to the sand-preparing department for the careful extraction of core irons, chills, etc., and if properly milled a proportion can again be used in new mixtures. Good results have been obtained by the use of 30 per cent. returned sand in each new coresand mixture, and this percentage can, of course, be varied to give the most satisfactory results, in relation to the fineness required in the finished core.

The mixing of sand and binder can be carried out in many various types and designs of mixing machines, either partly or wholly mechanical. One of the most efficient machines for the mixing of coresand with oil binder is the "Rotoil" mixer, which has the kneading action without the grinding or breaking-down of the sand grains.

In practically every case it is important that all foreign matter, such as tramp iron, core wire, etc., be extracted from the sand prior to discharge into the mixing machines, and this can be carried out mechanically either by the use of rotary magnets or vibrating screens. Careful attention to this point may save unnecessary maintenance cost and breakdowns.

Transport Costs

After mixing the sand has to be transported to the coremakers, and this is a problem that must have relation to volume of output and any special conditions. One of two methods should have careful consideration:—(1) The transport of the sand by manual labour in wheel bogies, or (2) by means of a mechanical conveyor. Here it is necessary to compare the balance between that of labour and that of capital outlay, depreciation and maintenance.

In most cases the small- or medium-sized foundry will find it cheaper to transport coresand in bogies, which method has the added advantage of elasticity. Special galvanised-steel bogies* can be designed, having swivel castors, and so constructed that they can directly receive the prepared sand from the discharge of the mixing machine and then be wheeled to the coremakers. The sand is preferably retained by the coremakers in these bogies and, when emptied, returned to the sand-preparing department for refilling.

LABOUR

The type of labour employed for coremaking varies according to the class of work, and whilst men and boys must of necessity be used in making large and heavy cores, girls are far more suited and adaptable to the mass production of cores of small and medium sizes. Apart from the fact of lower basis wages than men, girls generally are better suited to handling delicate pieces, as their fingers are more nimble. It may be argued that a skilled male coremaker who has spent a number of years as an apprentice must have acquired more knowledge of the art of coremaking, such as correct and suitable ramming and venting, and should therefore produce a better core, and whilst it is true that the skilled male coremaker will always be in demand for either the jobbing shop or the production of large cores, nevertheless girls, aided by modern equipment and materials, can be trained to make economically small- and medium-sized cores on mass-production lines.

Wages

Where there is quantity production, undoubtedly payment of wages to coremakers should be based on payment by results, preferably piecework. In this connection it is appreciated that in the initial stages, when starting a basis of piecework prices, there is a very great amount of data to be collected and either estimating or timing to be carried out, but once this has been effected and the prices established, it is comparatively easy to keep prices up to date, and new items added as this becomes necessary.

It is usual to base piecework prices on units of either dozens or hundreds, and, when wishing to put into operation a "payment-by-result-scheme," it is first necessary to take the actual production time required to produce a certain quantity of one type of core, and on this result establish a piecework price for one hundred such cores. It must be remembered that if piecework prices are to be based on an actual check of production time, then it should be fairly formed on the output of a coremaker of *average* speed and skill, and which should result in the fixing of a price that will tend to speed up the slower producer and at the same time give encouragement to the fastest.

Having fixed piecework prices, the attention of the management should not cease at this point. At regular intervals, preferably weekly, a check should be made of all piecework prices in relation to the output and wages earned by individual producers. It may often be found that where a piecework price may have appeared rather low during the initial period of production of a new line of cores, either continual practice by the coremaker or a modification of equipment may have so increased production that a revision in price may be necessary. On the other hand, it may clearly show the original basis of production to have been over-estimated and requiring adjustment of the price. The system of payment of wages based on piecework prices against that of daywork or time basis has five great advantages:—(1) It creates competition between individual producers, and also gives them that encouragement which leads to greater production; (2) it stabilises the cost of production; (3) it quickly shows the management the comparative output and working efficiency of individual employees; (4) it clearly indicates those jobs which are showing a loss and call for the special attention and investigation of the management; and (5) it greatly simplifies the work of the estimator when working out a tender for a new line, as generally there is a similar job in existence for which there is already a fixed piecework price, or in any case one that will give some guide to the cost of production.

Payment by Result

If it is decided to install a "payment by result" scheme, what is the best method of payment to employees of the two methods: (1) Payment to employees on individual piecework earnings, or (2) payment to employees on the gang or group system? The argument in favour of the former method is the encouragement this gives to the most efficient and quickest worker and the corresponding enforced speeding up of the less experienced; but this equally applies to the gang system if properly balanced, and a danger of the first method is the possible favouritism of a charge hand reserving the most lucrative jobs for favourites and also the reserving of the highest class of work exclusively to the most able employees, and thus tending to prevent others from attaining the same standard of skill.

* A Paper read at the London Branch of the Institute of British Foundrymen, Mr. V. Delport presiding.

* See FOUNDRY TRADE JOURNAL, Vol. 53, p. 363.

In introducing the gang system to the coreshop it is first necessary to decide whether it is possible to cover all its employees in one gang, or whether it is advantageous to split it up into separate gangs or various classes of work, such as in the case of a foundry producing ferrous and non-ferrous castings, one group of employees producing cores for the non-ferrous and one for the ferrous departments. Again, it may be necessary to form one gang of male workers and another of female, or a gang of hand coremakers and a separate gang of coremakers producing cores from blowing machines. From the foregoing it will be appreciated that the number of gangs introduced must depend upon the conditions existing in each coreshop, but, generally speaking, it is advisable to keep the number of gangs down to a minimum, so ensuring as little work as possible for the time, wages and cost offices.

Having fixed the number of gangs, it is then necessary to schedule the basis of day-work rates of the individuals forming each gang. For example, in a gang of 20 girls varying in age from 14 to 26, the day-rate basis may range from 15s. to 30s. per week, but quite apart from the recognised day rates fixed in relation to employees' ages, in actual practice it is found that if at any time the management wishes to give encouragement to an individual showing exceptional ability and keenness, then, quite apart from age, his or her rate can be increased to allow the opportunity of earning a larger share of the bonus resulting from a payment by result scheme.

The same fixed piecework prices apply to all coremakers forming a gang, and the total earnings of the gang at the end of a week are divided equally in proportion to the employees' day-work rate and number of hours worked.

Job Cards

For the purpose of keeping accurate costs and to ensure correct payment of wages, it is usual to keep records of time worked and quantities of cores produced on the job-card system. Each time before a coremaker commences production on a new order for cores he or she should apply to the time clerk, who will make out a job card for the specific order, giving particulars of the quantity and type of cores so covered, and who will clock the time of commencement and completion. If there are a number of gangs in a coreshop it is easy to keep each gang's job cards separate by using cards of different colours. As an order is finished the job card is completed and the particulars taken from the front are analysed and extended on the back to show the total number of hours worked and wages earned, and at the end of the week the total number of job cards are analysed to arrive at the total earnings of the gang.

To ensure that the correct number of cores are produced as called for by orders, it is advisable to provide a method of checking, and this can take place either at the same time as core inspection or immediately after, and a further check can be made as cores are issued from the coreshop to the moulders. In any case a quantity check should be made on cores *after* passing inspection, as this ensures that wages are only paid on good cores produced and prevents the possibility of a coremaker scamping work to maintain a high speed of output. Allowance has, of course, to be made for the rejection of cores due to corebox inaccuracy or any other contingency outside the control of the core producer.

Perhaps one of the dangers of payment on piecework prices is the possible scamping of work and insufficient attention given to detail by a coremaker in an endeavour to obtain greater speed of production, and if this is to be avoided it is of extreme importance that piecework prices are so fixed that enable the producer to earn a reasonable bonus without having to omit important production details, and if this point is taken care of, then to ensure efficiency coremakers should be penalised for bad workmanship even if this is only discovered and definitely proved at some later stage in the foundry production.

Finally, it should be pointed out that one of the greatest advantages of the gang system is that it considerably relieves the management of the supervision of employees, as they themselves automatically ensure that each member of the gang is pulling his or her weight and producing good cores to the benefit of all concerned. A further advantage of this system is that, unlike the case of the individual piecework earner, it encourages the more skilled employees to help and supervise the learners.

OVERHEADS

Under this heading it is proposed to cover the various types of plant, equipment and appliances used in the coreshop and their relation to cost. Of first importance is the question of coreboxes, and probably the greatest saving in cost in relation to the coreshop can originate from the patternshop which, in conjunction with the foundry management, is responsible for the design and type of coreboxes used. For a coreshop producing large quantities of repetition cores and especially where girl labour is extensively employed, the use of aluminium-alloy coreboxes will considerably increase production and show a corresponding saving in cost as compared with the use of cast-iron or wooden boxes.

It is appreciated that the initial cost and outlay of making aluminium-alloy coreboxes is high, but where the quantities of cores required will allow, this is largely offset by the accuracy that can be maintained and the ease of handling. A heavy charge incurred by the coreshop is the cost of corebox repairs and maintenance, and with a view to reducing wear the "Newman" air-operated corebox vice was developed. This consists of a strong open-sided frame, to the upper portion of which the air vice (with operating and piston-speed controlling valves) is attached, this unit being adjustable in height to suit coreboxes of varying depths. The frame is bolted to a base which also carries the revolving table with a vibrating head in the centre, upon which the corebox is placed preparatory to being gripped by the vice. This table has a ball-thrust bearing, which enables the box to be freely rotated under pressure by means of handles provided for the purpose. A knee valve is provided to work the vibrator, leaving the operator's hands free.

The operator having filled both halves of a corebox, the two parts are lightly put together and placed on the table of the machine; the operating valve is then opened, for admitting air to the piston of the vice, which presses down on the box, closing the two halves tightly together. The ends of the sand cores are then packed as necessary, reinforcing wires inserted if these are required and have not already been placed in position in the sand, and the core vented in the usual manner. This having been completed, the knee valve is pressed, which works the vibrator for a few seconds, the core is loosened in the box, which is then released from the vice, and the core removed without the box having been given any hammer blows.

Although this machine is primarily intended for use with expensive metal coreboxes, it is equally suitable for wooden coreboxes, and it must be remembered that the advantages claimed do not suggest an increased output of cores, except as the result of less fatigue to the operator; but, of utmost importance, it does greatly extend the life of expensive boxes due to the elimination of the more usual method of rapping by means of a mallet or hammer. It further produces more uniform cores than by the old hand-rapping method, and largely eliminates the trouble of distortion and overlap.

Coreblowing

The most modern method of core production is that of coreblowing. For a number of years considerable attention and inventive thought have been given to the problem of making cores by the medium of compressed air. The first and most successful type of coreblowing machines produced were limited to the use of soft-bonded and easily-flowing coresand, and whilst great strides have been made in developing machines that will handle normally strong-bonded sand, there are many who still consider that, in spite of the cost involved in having to provide core carriers or driers, the earlier type of machine takes care of the production of varying types and sizes of cores more easily.

The two greatest difficulties experienced in endeavouring to blow bonded sand were the formation of air pockets in the cores and the cutting and wearing of coreboxes by the sandblast-like action which took place when filling either by the use of compressed air applied beneath or above a reservoir of sand, and even when the sand in the reservoir was kept mechanically in motion, these troubles still persisted. To-day these difficulties have been greatly minimised, but unless careful consideration is given to the design of a corebox, and more particularly to the means of giving free exit for the air which enters the corebox with the sand, either the core is not blown completely or else air pockets are formed. These same problems do not exist with the coreblowing machine handling a straight silica sand and thin oil mixture, and in addition there are a number of advantages, such as no necessity of venting or wiring, and the core when baked is moisture-proof. The disadvantage of this type of machine is having to provide a considerable quantity of metal carriers to hold the core in shape until dried, and in view of this cost, it is necessary to ensure that the design of cores intended to be blown are not likely to be subject to alteration which would render the carriers of no further use.

In spite of this disadvantage, there is no doubt that the coreblower provides the cheapest form of mass production of cores, and a daily output of between 1,500 and 2,000 cores of moderate size and simple design can be easily obtained.

In common with most forms of semi- or fully-automatic machines, maximum production is only limited to the greatest number of times a machine can consecutively carry out its mechanical operations, and it is therefore necessary to give careful consideration to the number of operators to be employed on a machine to obtain the best results. Normally, a coreblowing machine requires at least two operators, one to feed and work the machine and one to remove blown cores from the boxes and re-assemble for re-blowing, but in many cases the number of operators can still further be increased to as many as six per machine, and, if supplied with a sufficient number of duplicate coreboxes, the production is correspondingly greater.

Many people are under the wrong impression that the use of coreblowing machines is limited to the making of only simple cores, but in general it can be said that any reasonable size and type of core is capable of being blown, if the quantities required warrant the manufacture of duplicate boxes and metal carriers.

Other forms of coremaking machines are the pattern draw machine (with or without turnover) and the multiple rotary core machine, both of which can be used to great advantage for the production of certain classes and types of cores, and particularly when the quantity of cores required does not warrant the making of the more expensive equipment for blowing.

Conveyor Practice

The next stage in sequence of production is the conveying of the green cores either from the hand coremakers or blowing machines to the drying ovens. Consideration must be given to which of three types of conveyors can be best used, and the decision will, of course, largely depend upon the quantity and type of cores to be handled. The cheapest form of conveyor is the gravity roller type, and whilst this can be adapted to handle certain types of non-fragile cores, its use is limited where the danger of

vibration or jar may cause distortions or breakages. The power-driven steel-band conveyor is eminently suitable for handling small and fragile pieces, and is to all intents and purposes vibrationless, but this type is generally restricted to straight-line conveying, and for this reason it does not lend itself to the flexibility of taking care of altered lay-outs or extensions.

The most adaptable and flexible type of conveyor is the pendulum type, which cannot only turn and bend in any direction to suit an existing coreshop lay-out, but can also rise and fall from floor to roof level, and in this way can often save valuable floor space. Further, it is easily extended, and if the pendulum trays are fitted with springs or shock-absorbers, the danger of vibration is practically eliminated. Where a pendulum conveyor is installed in a coreshop, it can be arranged not only to convey the green cores from the producers to the ovens. but also the dried cores from the ovens to the stores or directly to the moulders, and thus be utilised to save other expensive handling charges.

In general, the use of either of these three types of conveyors will show a considerable saving in the cost of handling, especially in the large mass-production shop, and in addition tend to increase output, as it sets a pace for the producer and saves the fatigue otherwise involved in having to transport cores and plates either to racks or tables by hand.

Continuous Core Ovens

There are two modern types of core-drying ovens, namely, the "continuous" and the "batch" drying units. Heating in either type may be by coke, oil, gas or electricity, but for economy and all-round efficiency the forced-draft coke-fired furnace or hot-air producer is generally recommended. The continuous type of stove is comprised of a series of vertical chambers through which the cores are conveyed on an endless-chain-type pendulum conveyor. Normally, there are three chambers, the first covering the preheating and preliminary drying, the second the final drying and the third cooling. The cores are loaded on to the pendulum trays at the front of the first chamber, and pass up and down the consecutive chambers, finally being discharged at the back from the cooling chamber. The fuel cost for running these continuous stoves varies between 10d. and 1s. 6d. per ton of cores dried, according to type of work, the driving power required being only about 1½ to 2½ h.p., so that the total running cost is small.

Considerations in favour of the continuous system are small floor space, absence of all fumes and excess heat, and the almost entire elimination of accidental damage transporting both green and dried cores during loading and unloading.

Batch Ovens

The modern "batch" drying type of oven is not quite so well known as the "continuous," and a fuller description may be necessary. It consists of a number of chambers, each being divided into partitions by vertical racks and stays, with small angle-iron slides placed at such a short pitch so that the whole chamber can be completely filled with core trays according to the core sizes and no available space is wasted. The ovens, which should be internally insulated by asbestos mattresses, are heated by CO_2 gas entirely free from dust, which CO_2 is obtained from a hot-air producer with double combustion of special construction.

The CO gas is generated in the producer and is subsequently converted into CO_2 gas in a secondary combustion chamber integral with the producer by the introduction of air supplied under pressure by a small fan driven by a motor. The resultant non-combustible hot air is then passed from the bottom of the producer into an insulated duct which is built under the ovens. In this duct there is a controlled outlet under the bottom of each oven, which regulates the volume of hot air which it is desired to introduce into each separate oven.

At the bottom of each oven is a hot-air trough which distributes the air into each oven through perforated grid plates which form the floors of the ovens, and which can be easily removed for cleaning out broken cores, etc., which may fall through into the troughs. By means of an adjustable deflecting plate in the trough more or less hot air can be distributed into any portion of the oven according to the size and weight of the cores charged therein.

The hot oil-vapour given off by the cores in the process of being dried and the waste heat is exhausted evenly from the top of each oven by an independent uptake, in which a butterfly valve is fixed for control. All the controls, both for the inlet of hot air into the troughs and outlet of waste heat, are within easy reach of the operator, and an automatic cut-out controls the exhaust valves by the opening of the doors, and thus prevents any wastage of heat during their frequent opening for charge and discharge.

The hot-air producer is charged with coke two or three times a day, and is banked with low-grade coke under natural draft during the night, so that in 10 to 15 min. after starting up in the morning, by switching on the small pressure fan which supplies air to the producer, the full volume of high-temperature hot air is available. A constant temperature of from 450 to 500 deg. Fah. (230 to 260 deg. C.) is maintained throughout the day in the various ovens.

The coke consumption of the producer is about 2 cwts. of coke per working day of 8½ hrs. for maintaining the necessary heat in eight ovens capable of dealing with 600 to 800 sq. ft. of plates of light cores per hr., or in the case of cores for various types of valves ranging from ¼ in. size to 6 in. an output of between 12,000 and 15,000 cores per day. The hot-air producer, the main duct and the hot-air troughs below the ovens must all be very completely insulated so as to eliminate any loss of heat by radiation.

The advantage of the batch-drying system is its flexibility in taking care of varying production requirements, and, most important of all, it enables the segregation of the small, medium and large cores, so that each class can be dried in the minimum time and so avoid either the burning of small cores or the slowing down of the time required to bake large cores to take care of the smaller. There is, of course, nothing new about the batch-drying system, but efficiency has been improved by new methods of heating and the use of modern insulating materials and the process cost very much reduced.

After drying, cores should be thoroughly inspected and checked and any cleaning or patching then carried out, and although this cost must be born by the overheads of the coreshop department, it must be realised that a careful scrutiny and check of cores prior to issue to the moulders will prevent unnecessary trouble and expense elsewhere in the foundry.

Conclusions

An attempt has been made to review in a very broad manner those items which go to make up the cost of core production and has indicated possible economies that can be made by the study of individual processes and by the introduction of modern plant. Each succeeding year the engineer demands closer tolerances of machining limits and the importance of clean, accurate and economic coremaking cannot be over-emphasised if the ultimate castings are to be accepted as coming within the standards demanded.

Finally, in common with all other producing departments, the questions of good light, good ventilation, bright and healthy surroundings, coupled with humane welfare considerations, apply equally as much to the coreshop as to any other department, and have an unobtrusive, but nevertheless important, bearing upon the cost of producing cores.

Electric Furnaces

INCREASING CAPACITY AND USE

At an informal meeting of the Institution of Electrical Engineers, held on March 9, in London, Mr. J. F. Shipley in the chair, Mr. W. S. Gifford opened a discussion on "Electric Furnaces," pointing out that the total connected load of all types of electric furnaces in the United Kingdom was at least 150,000 kw. When times were good, as at present, most furnaces worked continuously for five and a-half days a week, so that the total annual consumption was not less than 450,000,000 kw.-hrs. With power at 0.5d. per unit, this represented an annual power bill of about £1,000,000. The total plant ordered last year was at least 30,000 kw., which was equivalent to over 75,000,000 kw.-hrs. per annum, or an additional power bill of over £150,000. The value of this load should be recognised and encouraged by offers of reasonable power contracts. In some instances special terms were given to electric-furnace users, but the practice was by no means general.

Proceeding, the speaker recalled that the main types of electric furnaces were the arc, induction (normal and high-frequency) and resistance. Arc furnaces, which were principally used for steelmaking and the production of ferro-alloys and carbide, had been commercially developed for about 26 years. The broad outlines were much the same as those of the original furnaces designed by Héroult. The principal modifications in modern furnaces were the increase of transformer rating, with a corresponding increase of voltage, and the provision in some cases of removable roofs to facilitate rapid charging.

Another type of furnace more recently introduced into steelmaking was the high-frequency or coreless-induction furnace, which was now being very widely used for the manufacture of high-grade steel. Frequencies varying from 500 to 2,200 were used, the size of furnace ranging from 100 lbs. to 5 tons, and the power from 30 to 1,250 kw. A high-frequency furnace installation consisted of a motor generator; a bank of condensers to improve the power factor, which were arranged so that part were constantly in circuit and the balance were divided into a number of units which could be switched in or out to suit the varying load conditions; and one or more furnaces with the necessary tilting motors, cables, etc.

The Ajax-Wyatt, a normal-frequency induction furnace (continued the speaker), was very widely used for the production of brass. About 1,000 of these furnaces were in operation in various countries, including about 90 in England. This type of furnace was extremely efficient, and easy and cheap to operate, but was unsuitable for melting high-temperature material such as steel, or for making a wide range of different products. These furnaces were usually of 600, 1,200 or 2,400 lbs. capacity, with transformers of 75, 150 or 300 k.v.a.

Other types of furnace which were of interest for melting bronze and cast iron in relatively small units were the rocking resistor and the rocking arc furnaces. In the former heat was supplied by a graphite resistor rod, and in the latter by a horizontal arc. In both types the furnace was rocked to ensure thorough mixing and to increase the life of the refractories. These furnaces were limited in size, as they were only suitable for single-phase current.

A recent very important advance, said the speaker, had been made in high-frequency induction heating. Crankshafts and similar articles were heated by current at about 2,000 cycles carried by hollow inductor coils, and rapidly quenched by water squirted through holes in the coils. By this means very efficient surface hardening was obtained extremely rapidly. The actual heating period was only 7 sec., and the complete cycle, including quenching and setting up the coil, was under 45 sec.

Leaves from a Foundryman's Notebook

X.—VERTICAL SWEEPING METHODS

By "RECORDER"

Previous articles in this series which have been devoted to examples of loam work, have given descriptions of the moulding of castings of large diameter as compared to their depth, as, for instance, drum sides, sheave wheels, etc. The following notes deal with castings the depth of which is greater than their diameter. Such castings as steam cylinders, air pumps, flange pipes, etc., come in this category, and the example chosen for description is a plain cylindrical casting, as in Fig. 1.

This job can be produced by one of two methods, depending on the facilities of the foundry doing the work. Shops that were laid out for this class of work usually had a special place where the mould or core could be dried in one, whereas jobbing shops often have to make the mould and core in sections to enable them to enter through the drying-stove door. Taking the latter case first, the mould can be conveniently made by two sweeping boards, as shown in Fig. 2, A making the lower portion while B makes the top, the joint in the mould being taken on the top of the bead A, Fig. 1. The bottom flange is made as for a previous example by the loose finger C.

After striking the flange, the detachable portion C of the sweep is removed, and the mould

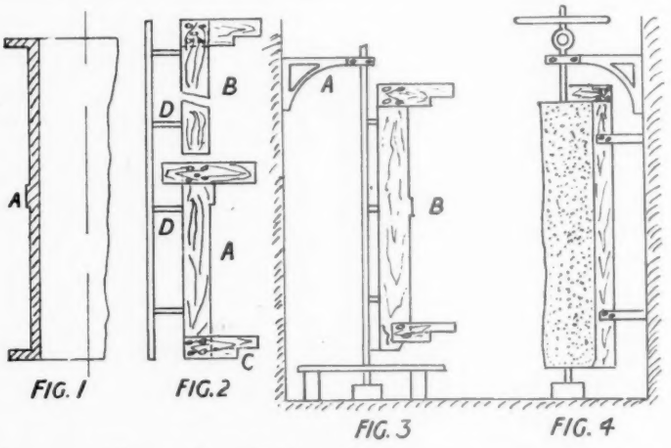

FIG. 1 FIG. 2 FIG. 3 FIG. 4

thickened with new moulding sand. A building ring is then introduced to carry the subsequent structure, which is reinforced about every foot in height with other rings. A point to remember in building is to keep the snugs of the various intermediary rings clear of the foundation-plate snug. These snugs must be in line with the arms of a heavy cross to facilitate the introduction of slings which pass over the arms and snugs and are wedged in position in order to guard against "lift" during casting.

The sweeping boards A and B are made narrow, and the correct distance from the centre bar is obtained by inserting a number of hardwood pins in the boards, as at D. The reason for this is to avoid a large surface of wood, which, when in contact with the wet loam, tends to buckle, thus throwing the job out of truth. Of course, gauge sticks would be used to test the accuracy of the job. The moulds having been prepared, they are stoved, and a start is made on the cores.

Core-Making Details

The bottom portion of the core is made on the same plate as the bottom flange, thus ensuring centrality without the use of a print. This core is also made about 6 in. higher than the joint in the mould. The reason for this is that, on assembly, the first part of the mould—made with board A—is placed down over the lower portion of the core on to the foundation plate, when the lower core will stand above the joint. The second portion of the core is then placed in position and the joint between both well filled to avoid metal pressing into it.

The core is reinforced at intervals with metal stiffeners. These are produced in a mould of the required diameter, and about 3 to 4 in. deep, by pouring in a little metal. This sets quickly and others are cast at regular intervals, the one mould giving a number of stiffeners. The core for the example, Fig. 1, must be well made, especially in the bottom section, to withstand the pressure of metal due to its height. Jobs of this type often carry a "head" of metal to catch sullage, etc., and are run by a combination of top and bottom pouring. A description of this appeared in THE FOUNDRY TRADE JOURNAL for September 14, 1933, page 151, and Fig. 7.

Making this type of casting under more favourable circumstances, the mould sweep can be of one length, but as this job is so high, the spindle arrangement described before is insufficient, as the weight of the board would cause it to rotate out of truth. Therefore, in conjunction with the previous arrangement, a gear, as shown at A, Fig. 3, extending from the foundry wall, is used, thereby ensuring that the spindle is vertical and stable.

For this method the core is inserted in a print, usually about 6 in. deep, with a taper of 1 in. per ft. The sweep is made in one piece, as in Fig. 3, B, and the bottom flange is treated as before. The only difference in this method from the previous one is that the mould is made in one length, the core is in one piece, and inserted in a print, and the additional support given to the spindle. The method of producing the core in one piece is shown in Fig. 4. An iron plate of diameter a little less than that of the bottom print is procured, through and on to which a square shaft with a turned bottom is fastened. This is then placed in a footstep, as indicated in former examples.

The top of this bar is also turned, and works in an arrangement extending from the foundry wall. Beneath this is keyed a large-diameter hand-wheel, and a portion of the bar is drawn out in the form of an eye for lifting, as shown in Fig. 4. This arrangement is not used as for ordinary vertical sweeping, but rather as for horizontal sweeping, in that the core rotates and the board remains stationary. This board is fastened in place by bolting it to two iron projections extending from the wall, and is set by top and bottom gauges running over the turned portion of the bar.

A staging having been erected, a couple of boys rotate the whole contraption, while a moulder standing in one place builds the core, a staging being erected for him as the height increases. After reaching the top, the hand-wheel is taken off, and the core dried. The assembling of this is an easier job than by the previous method, and is more satisfactory and should be adopted whenever practicable.

Correspondence

[We accept no responsibility for the statements made or opinions expressed by our correspondents.]

Metal Melting Costs

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—In the current issue of THE FOUNDRY TRADE JOURNAL there appears the reproduction of a Paper by Mr. A. Logan, entitled "Non-Ferrous Castings." In this Paper the author gives figures for melting metal in semi-rotary non-crucible furnaces and crucible furnaces.

We, as manufacturers and users of this type of furnace, venture to suggest that the figures quoted for the semi-rotary furnace err on the high side and thus make it appear that the non-crucible furnace is more expensive to operate than the crucible type.

This, according to our own experience, is not so. In the first place, the price given for fuel is 4d. per gallon. We do not think fuel oil can be bought at that price. The author has possibly omitted the 1d. tax, for, according to our information, the average price throughout this country would be 5d. per gallon.

The following figures have been obtained over a number of years' working of three semi-rotary furnaces and are, if anything, on the generous side:—

SEMI-ROTARY NON-CRUCIBLE BASED ON FUEL AT 5D. PER GALLON.

Author's Figures (fuel cost revised).

	s.	d.
22 galls. fuel per ton	9	2
Metal loss	19	3
Furnace repairs	4	0
Power	1	0
Labour cost	3	0
	36	5

Our Figures.

16 galls. fuel per ton	6	8
Metal loss	19	3
Furnace repairs		6
Power	1	0
Labour cost	2	0
	29	5

CRUCIBLE TYPE. FUEL AT 5D. PER GALLON.

Author's Figures (fuel cost revised).

28 galls. fuel	11	8
Crucible cost	4	0
Metal loss	8	3
Furnace repairs	2	0
Power	1	0
Labour	4	0
	30	11

From the foregoing table it will be observed that the semi-rotary non-crucible furnace compares very favourably with the crucible type, and, so far as the total quantity of fuel used is concerned, we find that 16 galls. is an average figure per ton of metal melted.

We have ventured to bring this matter to your notice as we do feel that the figures given in the Paper are not a fair comparison of the two types of furnace.—Yours, etc.,

W. FALKUS.

Sir W. G. Armstrong Whitworth & Company (Engineers), Limited,
Scotswood Works,
Newcastle-upon-Tyne 1.

The Manufacture of Portland Cement (Mechanical Processes)*

By J. H. BILLSON (Works Manager, The Ketton Portland Cement Company, Limited)

For the benefit of those who know nothing of the manufacture of Portland cement it may be as well to give a brief general outline of the process. Usually calcareous and argillaceous materials are used, though sometimes materials can be found where the constituents have been so mixed by nature that little correction is required. Limestone and clay, or chalk and clay, or sometimes chalk and river mud of suitable composition are materials mostly used. They are finely ground, intimately mixed, and properly proportioned under the control of a chemist.

There are two methods of manufacture employed, known as the wet and the dry. In the dry process the raw materials are dried before mixing and proportioning and handled as a powder; in the wet process no drying of raw materials is carried out, water being added as soon as convenient, the grinding and mixing is carried out in the presence of water and the mixture handled as a fluid. It is generally agreed, grinding with modern wet mills is more thorough than grinding the mixture dry, and the mixing is better. It is also more convenient to handle slurry by means of pumps and pipelines, than a raw material in powder form with elevators and conveyors. For the purpose of this description the wet process will be dealt with.

The chemically-correct slurry is fed by suitable apparatus to the kiln, where water is driven off and the constituents of the raw materials made to combine at a temperature of approximately 1,500 deg. C. The heat for the combination of the raw materials is obtained by means of powdered coal in this country, oil or natural gas being used abroad where these materials are easily obtained. The clinkered material is ground with a small percentage of gypsum in tube mills, it then being the finished product, after which it is conveyed to storage silos for packing and weighing.

This brief outline is given that the processes to be described later may be the more easily followed. It does not in any way claim to cover all processes, machines, or combinations of machines used in the manufacture of Portland cement. Its aim, however, is to give a general idea of the methods of manufacture and of the processes and machines found in most up-to-date cement works of to-day.

Winning of Raw Materials

In the case of hard limestone a face of from a few to 80 or 100 ft. deep may be worked, depending upon the formation of the rock. It is usual to endeavour to work a face as deep as possible, as it is more economical in the use of explosives. For holes of medium depth up to 30 ft. and 2½ to 3 in. in dia., compressed-air drills can be used, rapid drilling speed with good fragmentation of the rock after blasting being obtained. If the depth of the face is suitable and greater quantities of stone are required, churn or well drills are used, boring holes of much greater depth than air drills and from 3 in. to any reasonable diameter. For faces of 80 to 100 ft. deep holes of 6 in. to 8 in. dia. may be used. The modern machines are mounted on caterpillars and driven by petrol motor or electricity.

Where electricity is available this is much more convenient and requires less attention. With both types of drilling, several holes will be charged and fired at one time, the charge being so proportioned that the maximum tonnage of stone is moved, with the maximum of fragmentation to avoid secondary drilling of large blocks. After blasting the stone is loaded by steam or electric excavators, the latter coming into more general use with the advent of the greater availability of electricity. The electrically-driven excavator now being made is very reliable and much cheaper in operation than steam machines, there being no necessity to provide for water or coal supply, or the weekly washing out of boilers. With no steam-raising plant and the tripping of the bucket door release being done by electricity, one man only is required for its operation.

Soft chalks can be dealt with in two ways —by blasting and filling the fallen material by means of single large bucket excavators, or if the chalk is soft, a multi-bucket excavator (Fig. 1) can be used, no blasting being required. Multi-bucket excavators are a comparatively recent development and have the advantage of large outputs for comparatively small power consumption in suitable materials. The machine is mounted on a track at the top or bottom of the face to be worked, whichever is convenient, and a number of scoops or buckets of the elevator type are fitted to an endless chain. These buckets can be fitted with teeth, or have a plain cutting lip. Clay can be obtained by either the single large bucket or multi-bucket excavators. In the case of a works obtaining its clayey material from a river bed, a crane equipped with a grab on a floating raft is used.

Where chalk and clay occur some distance apart, one or both of them may be made into a slurry near the point at which they are obtained, and pumped to the works for mixing, proportioning, and, if necessary, further grinding. This is very convenient and economical where haulage is difficult. When materials are hauled to the works, this is done by steam or electric locomotives, and if small capacity wagons or Jubilee skips are used, by endless cable, or if there is a sufficient gradient, by single cable. For long or medium hauls locomotives are used; for comparatively short distances cable ways are an economical proposition.

If hard limestone is one of the raw materials it may be fed to a primary crusher by mechanical means, or tipped straight in. If fed mechanically the stone may be tipped on to a slope upon which very heavy endless chains are allowed to drag, the chains being suspended on a drum, the speed of which is under the control of an attendant who regulates the speed so that the crusher receives the stone regularly and up to its capacity.

The stone can also be tipped into a hopper, from which it is drawn by a grizzly feeder. This is a device consisting of a number of stationary and moving bars, the latter mounted on eccentrics. All are arranged at a slight angle to the horizontal and are V-shape in section. When working, the moving bars drop below the level of the stationary ones, at the same time moving in the opposite direction to the material. Near the end of the backward stroke the bars rise until they are higher than the stationary bars and so pick up the material and carry it forward. All the moving bars do not move in the same direction at the same time, and a gentle moving forward of the material is obtained. An advantage of this machine is that the "fines" pass between the bars and can meet the stream of crushed material without passing through the crushing machine.

Crushing Apparatus

The primary crusher is usually of the swing jaw type and reduces the stone to pieces about 6 to 8 in. cube or smaller, after which it is fed either to a cone crusher or a hammer mill. The former is a vertical machine, the opening being an inverted cone in shape, in which runs another cone-shaped unit running eccentrically. The hammer mill can in certain cases be used to do all the crushing, being capable of producing a very high proportion of "fines." When used as a secondary crusher a very small proportion of its output would remain on a ½-in. sieve.

After leaving the secondary crusher it has been the general practice to feed direct into hoppers above the slurry grinding mills, but of late years storage of raw materials has come into favour, so reducing the number of stoppages of machines on the works due to weather conditions and quarry machinery breakdowns.

Preparation of Raw Materials

In the case of soft chalks, these are usually tipped direct into a wash mill, where they are mixed with water into as thick a slurry as convenient for mixing with the clayey material and for pumping purposes. With soft materials clay can also be tipped into the same wash mill, the required composition being roughly obtained by mixing either so many weighed trucks of chalk with a weighed quantity of clay, or volumes may be taken. In any case, the mixture is finally corrected by adding more or less of either of these materials, upon directions from the works laboratory staff.

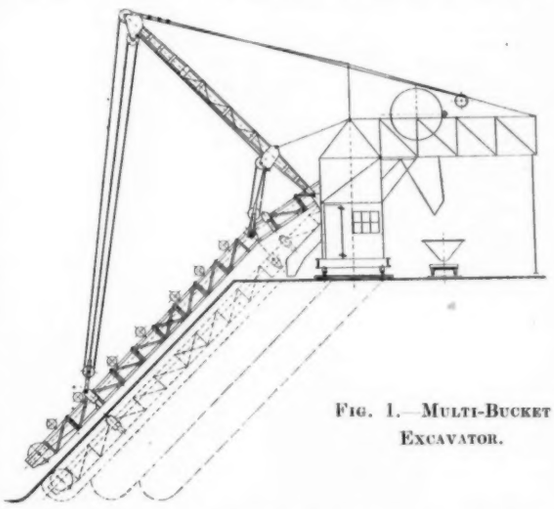

FIG. 1.—MULTI-BUCKET EXCAVATOR.

Returning to hard limestone, it falls by gravity from the hoppers on to a feed table, this being driven by a variable speed motor. An adjustable plough is fitted so that the amount of material scraped off the table can be regulated, both by the plough and by the speed of the table. The stone then falls into the feed hopper of a compound tube mill (Fig. 2), the clay to be added is brought to this point through a pipe-line, entering at the same time. If the clay slurry can be gravity fed, then the flow can be regulated simply by a valve or stop cock, though if much grit is present trouble may be experienced by the valve or cock blocking. There is also much wear of the regulating device. If gravity feed is not available, then the feed of clay may be regulated by a constant head tank, the overflow pipe of which is fitted with a sleeve to regulate the depth of slurry. There is a partition in the tank, having an opening covered by a sliding plate, to regulate the exact quantity required. Less blockage is likely to occur when the material is regulated in this way, but a pump is necessary.

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* A Paper read before the Sheffield Branch of the Institute of British Foundrymen on March 26, 1936.

The purpose of the tube mill (Fig. 2) is to grind finely and intimately mix the two materials. Until recent years this grinding and mixing was done in two mills, one being charged with steel balls up to 4 in. in dia., the other with smaller grinding bodies. The compound mill carries out the duties of these two units. Tube mills are of varying lengths and diameter according to the outputs required, and different mills are divided into different numbers of chambers, depending upon the type of material to be

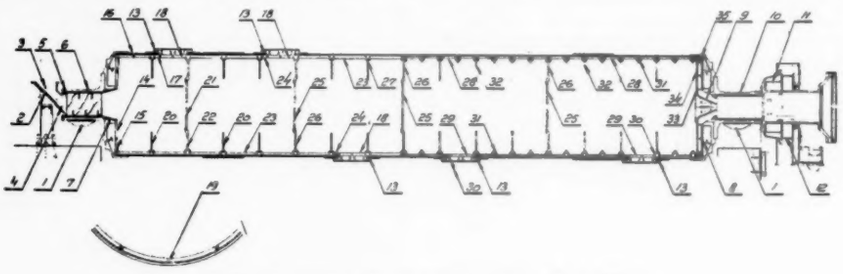

FIG. 2.—SECTIONAL VIEW OF COMPOUND TUBE MILL.

dealt with and what the manufacturers of the mills consider will give the desired fineness for any particular output.

Description of Mill

The mill shell is made of stout boiler plate supported on trunnion bearings. The unground materials enter through the feed-end trunnion, pass through the various compartments and leave, after grinding, through the other trunnion. The shell may be lined inside with, in some of its chambers, manganese-steel plates; in others, chromium-steel or white cast-iron plates. The diaphragms may be of manganese steel in some cases, and in others, chrome steel. Supposing the material is dealt with in a five-chamber mill, the chamber at the inlet end is loaded with steel balls not all of the same size, generally, various quantities of different sizes from 2½ to 4 in., depending upon the size of the material to be ground after leaving the secondary crusher.

The second chamber may be loaded with balls from 1½ to 2½ in. These chambers would generally be lined with manganese-steel plates. No. 3 chamber may be loaded with 1- to 1½-in. steel, hard cast iron, or cast-alloy balls and lined with manganese-steel or white cast-iron plates. Nos. 4 and 5 chambers would be charged with small steel or cast cylindrical grinding bodies, their length being approximately one and a-half times their diameter. These two chambers can also be lined with manganese-steel, white cast-iron or chrome-steel plates. White cast iron can be used in these last chambers because it does not have to withstand shock as is the case with the first grinding chambers. White cast iron does appear to withstand attrition very well, but it is possible to find a plate broken and the shell exposed—there is not this risk with manganese steel. The various charges of grinding bodies are separated by means of diaphragms, with slots diminishing from the inlet to the outlet of the mill, according to the size of the charge which they have to retain.

These slots are so constructed that they are self-cleaning in the event of material or grinding bodies being picked up by them. The diaphragms are of either manganese steel or chrome steel. The larger sizes of balls used for grinding are forged high carbon steel, the carbon being in the region of 0.75 per cent. The smaller sizes of balls may be of hard and tough cast iron, though they must not be too hard or they will soon break. The cylindrical grinding bodies can be cast or cropped from bar steel of suitable composition; the steel would be of high carbon content and in some cases heat treated.

Whether the mixed raw materials leave a wash mill or have been ground in a tube mill, their after treatment is much the same. The slurry is usually pumped to correction tanks, it now being general practice to use centrifugal pumps for this purpose. The advantages of these pumps over the piston or ram type of pump is their smaller number of working parts, less floor space and lower first cost. They move enormous quantities of material very quickly. In the case of cement slurry the volute and sides of the pump may be of cast iron, the impeller also, but longer life is obtained by having cast steel bodies with manganese steel impellers. When sufficient slurry has been pumped to the correcting tank it can be agitated either with compressed air or with mechanical stirrers.

Compressed air is the more usual method of doing this. After adjustment of the slurry mixture it is generally run into storage basins, from which it is supplied to the kiln. In some instances several days' supply can be stored in these basins. In other cases the slurry is first pumped to a tank of fairly large capacity, corrected in this tank and then fed to the kiln, more slurry being prepared and corrected in other tanks while the slurry from the first is being used. Where several days' supply of slurry is stored, care must be taken to ensure the consistency and mixture of the slurry remaining the same. There is no great risk of the raw materials separating if ground to modern standards of fineness when stored for a reasonable time, but the solid material may settle as a whole, leaving water on the top. This would then lead to pump trouble. To prevent this, storage basins are fitted either with mechanical stirring devices, usually of the Sun and Planet type, or with mechanical and air agitation, in the latter case thereby ensuring both horizontal and vertical mixing.

Making Cement Clinker

The corrected slurry from the storage basins is pumped to the kiln for drying, calcining and clinkering, these all being done in one machine. When the slurry is first pumped from the mixer, it enters a constant head and distributing tank. From here it flows to the kiln feed device, consisting of a spoon feed wheel which scoops up a given quantity according to the depth of slurry allowed to remain in the tank. The slurry passes through the trunnion of this wheel and the quantity being fed to the kiln can be checked by means of a measuring tank.

The tendency in recent years is to make kilns of increasing length for a given diameter, compared with the kilns of 10 to 20 years ago. This is to obtain increased efficiency and utilisation of the heat in the waste gases, and much work has in the last few years been concentrated on the rotary kiln to obtain greater efficiency from a given size of kiln in an endeavour to increase output and reduce coal consumption per ton of clinker produced. The kiln is one of the machines in a cement works which appears to be receiving most attention for cheapening the ultimate product. It is a cylinder built of boiler plate and can be anything up to 520 feet long and 12 feet in diameter. It is fitted with heavy solid steel tyres and supported on rollers at suitable distances apart. The burning zone of modern kilns is usually bigger than the drying zone. The usual practice was to fit the drying zone of these kilns with chains suspended in various ways, the object being to present as big an area to the hot gases as possible. Vanes and various shapes of slurry lifters have also been fitted with this object, but properly suspended chains seem to have given the least trouble for a given efficiency.

The Calcinator

Nowadays, though devices such as chains may be retained in kilns, attention is being given to the dewatering of the slurry before entering the kilns, either by means of rotary filters—though these have not been very readily adopted—or by a "Calcinator" type of machine. This latter is less complicated than a filter. It consists of a number of bars built into the form of a drum, supported on suitable rollers and bearings and rotating at slow speed. The drum is charged with hollow bodies, either cylindrical in shape with slots in them, or in the form of a double cone, the points of the cones being joined. A measured slurry feed is allowed to flow through suitable nozzles on to these bodies at their highest point of rotation in the drum. The slurry is distributed over the surfaces of these bodies and the hot gases from the kiln pass through the bars, and so through the slowly-tumbling bodies.

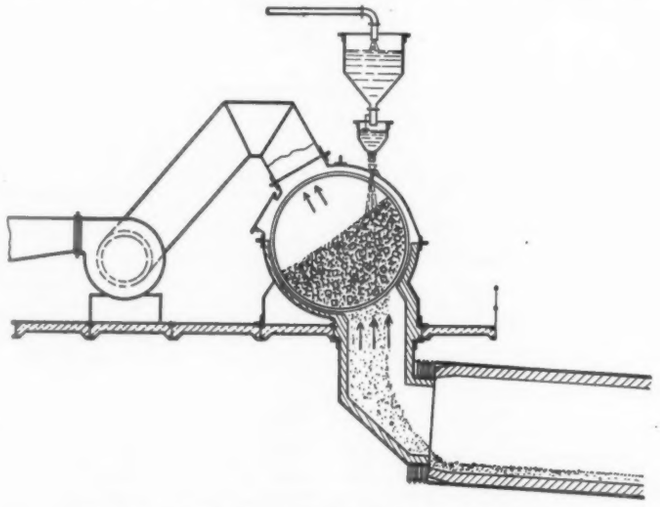

FIG. 3.—MIAG "CALCINATOR" OR SLURRY PRE-DRYER.

The object is much the same as chain systems and other devices in kilns, namely, to obtain as large an exposed area of slurry to the kiln exit gases as possible. As the bodies rotate in the drum the water is driven off and the partly-dried powder falls through the grate and so into

the kiln. These machines are claimed to save up to 25 per cent. in fuel and increase the output of a rotary kiln by the same percentage. An example is given of a temperature which would have escaped from the kiln in the ordinary way at 530 deg. C. leaving the calcinator at 110 deg. C. It is claimed also that the resulting clinker is more easily ground. Fig. 3 clearly shows how the machine operates.

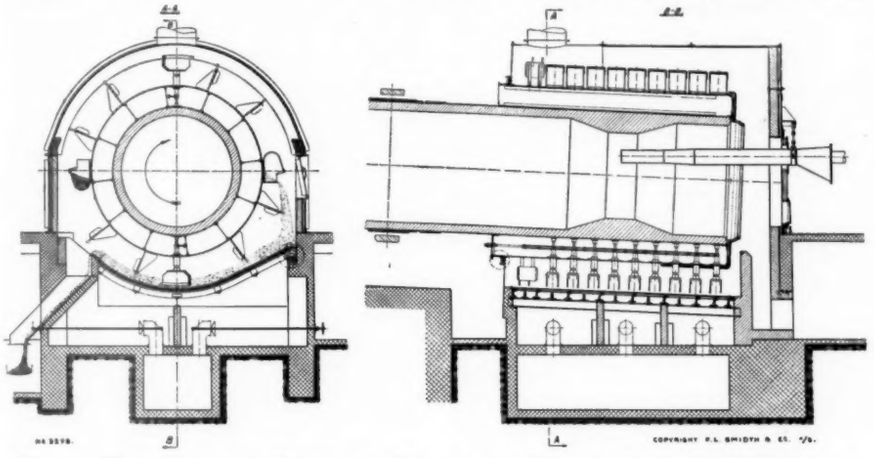

Fig. 4.—Kiln fitted with Scoops and Harrows and Separate Clinker Cooling Grate.

Refractory Details

The kiln is lined for practically its entire length with firebrick; at the slurry end where chains are used a fairly hard brick suitable to resist wear should be employed; in the middle third of the kiln the lining must be of a more refractory nature. The refractory material in the burning zone has to withstand very severe conditions and must be of the best to ensure the minimum of stoppages for renewals. A temperature of between 1,500 and 1,600 deg. C. is maintained in this zone; in addition to this the raw materials react with the firebrick and unless a bricks having a lower alumina and higher silica content. A refractory which gives excellent service in one kiln may not be nearly so suitable for another, due to differences in the raw cement materials, firing conditions and the fuel used.

As the dry slurry passes down the kiln the carbon dioxide is first driven off from the limestone or chalk until it reaches the burning zone. This is a comparatively short distance compared with the total length of the kiln, but a very high temperature is generated in this short zone by means of powdered fuel, and chemical combination between the various constituents of limestone, or chalk, and clay take place here, so that they are just fused or sintered together. Whereas the materials were all of fairly simple composition on entering the kiln, they now leave the burning zone in a very different chemical combination. After combination has taken place the material is like coarse gravel and consists of particles varying from pinhead size up to ½ in. diameter.

it. These coolers used to be lined with a hard, dense firebrick to withstand heat and wear; heat-resisting cast iron is now used, making it much quicker and more convenient to carry out repairs. The clinker, while still red-hot, passes through ports in the kiln and so into the coolers, which are fitted with lifter devices or looped chains, the object being to transmit heat from the cooler to these lifters or chains, or to expose as great an area as possible of the clinker to the secondary air drawn through the coolers for the purpose of combustion, so preheating the air and saving fuel at the point of combustion.

The latest practice, both British and American, has been to construct grates under the outlet of the kiln (Fig. 4). Their object is the same as chains and lifters in the coolers, but it is claimed they do the work much more efficiently. In one instance the clinker falls on to the grate. The periphery of the kiln is fitted with scoops and harrows, which can pick up and distribute the clinker over a fairly large area, air being admitted to this grate as required. The cooling is said to be much quicker than former cooling methods, and it is also claimed that the grinding of the clinker after quicker cooling is easier. Fig. 4 shows one of these grate coolers, two or three of which have been installed in this country recently.

Conveying and Grinding Cement Clinker

After leaving the cooler the clinker is dealt with either by shaking conveyors, vibrating conveyors or belt, the first being the more general practice. This shaking conveyor is a tray of the length required, supported on hangers in such a manner that as the tray swings forward it carries the material with it, but on returning it drops back very slightly under the material, and so takes the clinker forward in a continuous stream. Though the initial cost of these shaking conveyors may seem high, they are very reliable and their upkeep is small.

By means of suitable elevators the cement clinker can now either go direct to the hoppers above the cement-grinding mill or to a clinker store, which is the more usual practice. If an ordinary elevator is used the clinker is delivered to a belt or shaking conveyor, from which it is distributed to the desired points in the clinker store. There is a tunnel underneath the storage with openings at suitable intervals, allowing the clinker to fall on to another shaker or other apparatus. In some instances chain-bucket conveyors are used, both for hoisting and distri-

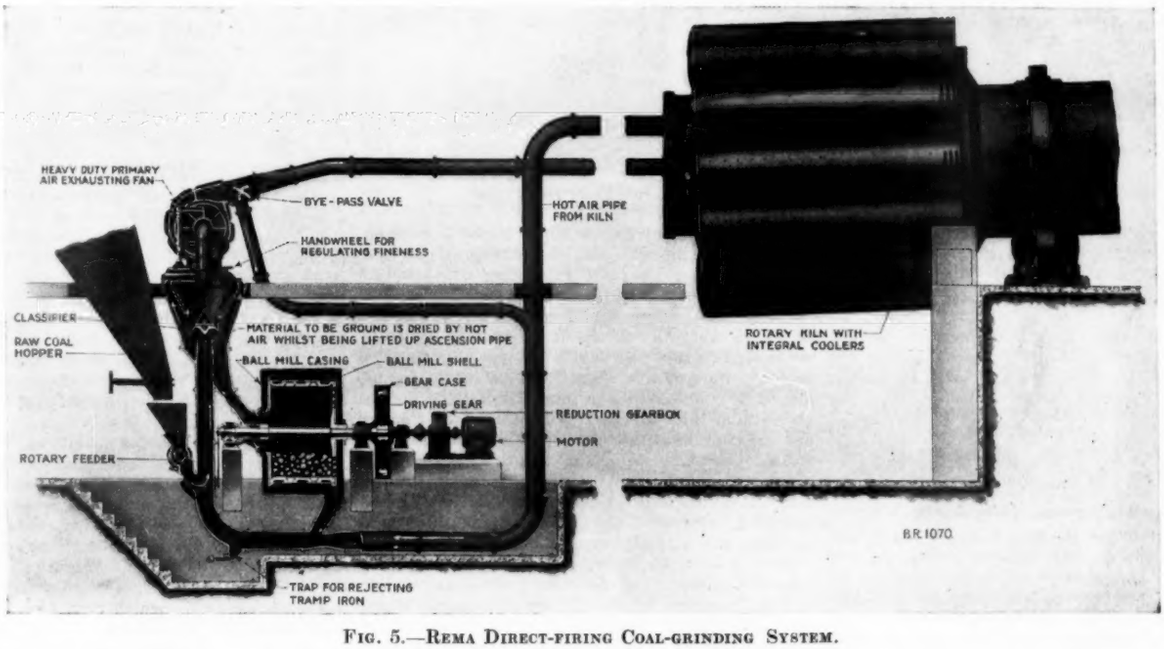

Fig. 5.—Rema Direct-firing Coal-grinding System.

coating of clinker several inches thick can be made to adhere and protect it, the firebrick would last only a few days. Refractory bricks of high alumina content have been developed in the last few years which, as well as having high refractory qualities, also assist the formation of a protective clinker coating, and much longer life is obtained than was formerly the case with

Attention has also been given to the outlet end of the kiln with a view to increased efficiency. Formerly the clinker cooler was a separate unit, being in shape similar to the kiln, but of very much lighter construction and shorter. Of late years instead of having a cooler as a separate unit, the practice has been to fit small cylinders round the outlet of the kiln, which rotate with

buting the material to horizontal points. Large tonnages of material are dealt with and stored in this way without any other handling whatever. In some cases the clinker is stored in a covered gantry equipped with a grab.

The cement grinding mills are similar in construction to the tube mills used for grinding raw materials, except that the inlet end is fitted with two feed tables—one for cement clinker and the other for gypsum. As the cement clinker varies very little it is unnecessary to drive the clinker feed table with a separate variable-speed motor, as in the case of hard limestone to a raw mill; it is therefore usually driven through suitable gearing from the cement mill. The gypsum feed table is coupled to the driving mechanism of the clinker table, and so adjusted that a constant quantity of gypsum is fed to the mill in relation to the quantity of clinker.

There is a prejudice by customers against receiving " hot cement " on the contract, so that water is usually sprayed on to the outside of the cement-grinding mills for cooling purposes. Mills have been constructed with water-cooling systems inside, but troubles have arisen and they did not run so consistently trouble-free as mills which are only cooled on the outside.

In some works the cement is weighed on leaving the mills as a check on their output and to know what cement is put into the storage silos. After leaving the weighing machine the cement can be elevated to silos either by bucket elevator, belt conveyor, or by a machine utilising air as a transporting medium. If the latter method is employed, then filters must be arranged at the top of the silos to prevent dust being blown into the atmosphere.

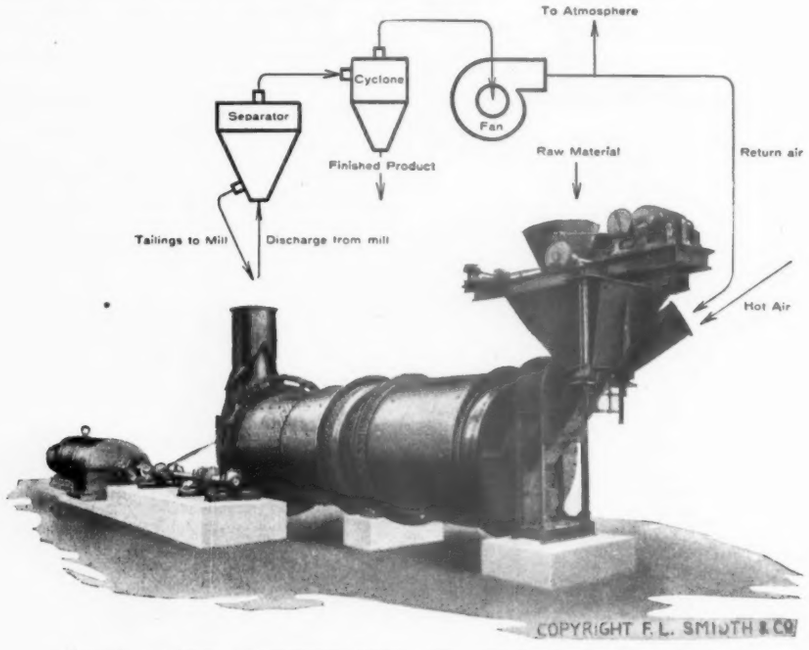

Fig. 6.—" Tirax " Combined Dryer and Tube Mill for Coal Grinding.

Bag Filling and Weighing

Arrangements for packing cement have advanced greatly during the last few years, vacuum and compressed air being utilised in most systems. Some of the original packing machines had two chambers, a bag was hung on a collar in one of these compartments, the door closed and a vacuum created in this chamber which was at the same time coupled by means of a flexible rubber hose to the cement storage. As the vacuum was created the cement flowed through the rubber hose into the bag until the correct weight had been obtained, the vacuum then being automatically broken. While this process was going on a bag was hung in the second chamber and when the first bag was filled the door of the second chamber was closed, a valve operated, and the process repeated. In this way one machine could fill and weigh between 6 and 7 tons of cement an hour.

There are other types of packers using purely mechanical means for filling bags. One of these consists essentially of an impeller on a shaft which throws the cement through a spout upon which hangs the bag to be filled, a simple arrangement being provided to stop the cement entering the bag when the desired weight has been obtained. One of the latest machines is called a Fluxo packer. The cement falls by gravity from the bin above the packing machine into a casing similar to a worm conveyor. A shaft fitted with paddles rotates in this casing and a little compressed air is injected, aerating the cement and making it fluid. It flows through a pneumatic valve and into a rotating cylinder. The purpose of the pneumatic valve is to stop the supply of cement when this cylinder is filled, and as the level of the cement in the rotating cylinder decreases, so the valve opens, allowing the flow of cement to continue.

The cylinder carries the whole of the bag filling and weighing mechanism, each filling and weighing unit, from four to eight, being fitted round the circumference of the cylinder. Each unit consists of a simple beam with a spout on one end and weights on the other. The spout is connected with the cylinder containing the cement, though not actually fastened to it, by means of a short rubber tube. When the bag is put on and the cylinder rotating, certain triggers are tripped and the cement flows through the rubber tube into the spout and so into the bag. As the bag is carried round, the cement stream into it is checked just before final weight is obtained. Beaters lightly hit the bags to tap out the air trapped in the cement. The last pound or two of cement runs into the bag just before it reaches the final tripping gear, which will not operate unless the correct weight is in the bag, thus ensuring that no bags containing short weight leave the machine. When the bag leaves the rotary packer it falls either down a shute direct into lorry or wagon, or on to a belt conveyor to which others are connected for transporting for either loading into wagon, boat or lorry.

Coal-Handling Equipment

In addition to the handling of raw materials a cement works must be equipped for the economical handling of fairly large quantities of coal. This arrives at the works in the form of slack, from dust up to nuts of about 1 in. cube. The wagons of coal are usually run on to a tippler and the contents of the wagon discharged in one operation. This coal is usually dropped into a hopper from which it is drawn by means of a belt. If the separate dryer and coal-mill method of grinding is used, the coal is put into the hopper above the coal dryer, falling from this hopper into a push feeder or screw feed device, which feeds the coal dryer. The dryer generally consists of a mild-steel shell in which there is a central tube coupled to a furnace fitted with a chain-grate stoker or other heat supply. The heat from the furnace passes down the central tube, meeting the coal in contra flow between the inner tube and outer shell. Suitable tumbling arrangements are fitted between the tube and shell so that the coal is cascaded and exposed as frequently as possible to the hot gases, actually coming into contact with the hot inner tube. On leaving the dryer the coal passes by means of suitable conveyors and elevators to the coal-grinding mill.

In principle, this coal-grinding mill is the same as the other tube mills previously described, except that there are not so many chambers. The mill may be lined with either Silex blocks or manganese or chrome-steel plates. Steel or cast-iron grinding bodies are used. The mill is fitted either with the usual type of feed table, or what is known as a cradle feeder. This latter is very much cleaner than a disc feed table, being entirely enclosed. The coal is ground to a residue of about 14 per cent. on a 180-mesh sieve and conveyed to storage bins upon leaving the mill. It is, however, usually arranged that this ground coal first passes over the coal hoppers actually feeding the kiln, and so ensures that the kiln has a constant supply. To keep the plant clean and at the same time to draw off any small quantity of steam which may be left in the coal, the fans which blow the coal into the kiln are coupled to the coal-drying system so that there is a suction on this system and coal dust does not escape.

The ground coal is drawn from the bins feeding the kiln by means of small screw conveyors, and falls into a high-velocity stream of air which carries it into the burning zone. Only just sufficient air is used to deliver the coal into the kiln as required, the remainder being drawn over the hot clinker as it leaves the kiln to utilise the heat in the clinker which would otherwise be wasted.

Recent methods of handling coal dispense with the dryer as a separate machine. In one (Fig. 5), a regulated quantity of coal upon falling into a pipe meets a stream of hot air which carries it into a classifier; during its journey to and for a short time while in the classifier the moisture is taken from the coal and passes on with such coal as is sufficiently fine, to an exhausting and blowing fan. The coarse coal separated in the classifier, falls through a shute into a ball mill. After grinding, the fine coal passes into the hot air stream utilised for lifting the original coal to the classifier, that which is fine enough passing through the fan direct to the kiln, the coarse particles being returned to the ball mill for further grinding. No storage hoppers are necessary, the required feed of coal for the kiln being made by regulation of the rough coal as it enters the system. Fig. 5 makes the working of this system clear. If desired this system can be used as a closed circuit system with storage bunkers, in which case a cyclone and air filter would be necessary. A definite one unit system has been used on some cement works. A disintegrator type of machine which dries, pulverises and blows the pulverised coal direct into the kiln is used. The machine has rotor and stator discs and fan in one casing, coal falls from a feeding device and almost immediately is drawn into the machine with hot air from a convenient supply. Freely pivoted hammers first

(*Concluded on page* 249.)

Institute of British Foundrymen

ANNUAL MEETING OF SCOTTISH BRANCH

The annual general meeting of the Scottish Branch of the Institute of British Foundrymen was held in the Royal Technical College, Glasgow, on March 14. The President, Mr. Daniel Sharpe, was in the chair.

The annual report, which was presented by the secretary, showed that the Branch had enjoyed a successful session, and the attendances at the meetings had been rather larger than in the past. The Edinburgh section had been somewhat difficult, but the matter was receiving the careful consideration of those who were in the best position to advise and help. In Falkirk the good work of the previous few sessions was being continued and consolidated. It was hoped that the stimulus of the Conference to be held in Scotland in June may help to advance the general welfare of the Institute in all three centres where the meetings are held. The financial side of the report was satisfactory, and the amount of subscriptions in arrear was the lowest for some years.

On the motion of Mr. D. Campbell, seconded by Mr. N. McManus, the report was adopted.

The President expressed his thanks to the Council and all those who had supported him during his term of office, and bespoke similar support for his successor.

New Officers

The election for office-bearers for next session resulted as follows:—

President—Mr. F. Hudson (Glenfield & Kennedy, Limited, Kilmarnock).

Senior Vice-President.—Mr. Duncan Walker (Mitchell Russell & Company, Bonnybridge).

Junior Vice-President.—Mr. Evan J. Ross (Argus Foundry Company, Limited, Thornliebank).

Members of Council.—Messrs. J. Brownlee (Bathgate), J. McGrandle (Glasgow) and W. Rolland (Govan).

Representatives to General Council.—Messrs. J. W. Donaldson, D.Sc., N. McManus, M.B.E., and R. Ballantine.

Representatives to Technical Council.—Messrs. A. Campion, F.I.C., and J. W. Donaldson, D.Sc.

Hon. Secretary.—Mr. John Bell.

Presentation of Surtees Prizes and Medals

The Chairman said that this year's Surtees competition produced a record number of entries in the Junior grade, and it was encouraging to find from the examiners' report that the standard of the work performed had improved with each succeeding competition, and that this time the standard was very high. It was very interesting to find that all the competitors came from the Stow College, with which their Branch was so closely connected. They had with them Mr. Makemson, their general secretary, and he proposed to take advantage of his presence and ask him to present the awards to the successful competitors.

Mr. T. Makemson said that it was a great pleasure to be with them, and he felt it an honour to be asked to award the medals and prizes to the successful candidates in the John Surtees Competition. One of the things he looked forward to every year was the Scottish Branch dinner, and it was a matter for regret that circumstances had made it impossible for him to be with them last December.

In presenting the Gold Medal to Mr. Matthew Russell, of Drysdale & Company, Limited, Mr. Makemson said it was a great honour to win the Surtees Gold Medal. He understood Mr. Russell had written an essay on "Fabrication as a Competitor to the Foundry," and had put forward methods by means of which this competition could be met. He had thus made a definite effort towards an improvement in foundry technique, and on that account he was to be very heartily congratulated.

The Silver Medal and the first prize in the Junior grade was presented to Mr. Douglas Robertson, of Babcock & Wilcox, Limited. The other prizes in the Junior grade were awarded to Messrs. James McQuilken, David Shaw, James Cleary and Alexander Harriss.

Mr. Makemson said that, in looking over the documents in connection with the John Surtees Competition which Mr. Campion had given to him, he noted two things in particular. Firstly, all the candidates who entered for the Junior grade were in attendance at the Stow College, which was an excellent sign. It meant that all those lads were undergoing a form of organised instruction. He had every respect for the young men who burnt the midnight oil and studied from books, but by attending systematic courses of instruction they had the advantage of discipline and guidance in their studies, which could never be obtained from books alone. The Scottish Branch should be proud of what they and their officers had done for that great college in the patternmaking and foundry departments. The second thing that impressed him was that in the conditions of entry for the Surtees competition, it was stated that it was open to men actually employed in the foundry, which ruled out the purely technical man. He did not like the distinction sometimes made between technical and so-called practical men. They were both needed, and each had his own sphere of action. The foundry trade to-day, progressing on technical lines, required both technical and practical workers, whose spheres of action naturally interlocked. The technical institutes all over the country were helping men to keep in touch with what was going on in the industry. Mr. Mayer, who founded the competition, and who was himself a very able and practical foundryman, had that idea and foresaw the necessity of an enlarged and clearer vision in the future.

Mr. Makemson said he would like to refer to the Branch annual report, and, in spite of Mr. Bell's pessimism, he thought that the Branch had had a very successful year. It was true the membership showed a slight decrease, but he thought it was probably only a temporary loss. It should, of course, be taken as a cautionary sign and, if the decrease persisted for two or three years, then it might be viewed seriously, and it would be necessary to investigate the cause. It had to be remembered that in the Branch there was no dead wood, and in the work at Edinburgh, which had been described as difficult, and at Falkirk, there was every reason to be proud of the Scottish Branch in all departments. He hoped that next year they would be able to report an increased membership, and that even the elusive 300 might be passed. He wished to offer his thanks to the Council and the governors for permitting him to take part in the Surtees Competition.

Mr. D. Sharpe (President) asked the meeting to express their thanks to Mr. Makemson for having come to them and presented the medals and prizes. He would like to tell Mr. Makemson in connection with his remarks regarding the Stow College that not only had the Branch done something for it, but that all parties responsible for the tuition and management in the patternmaking and moulding classes were operating as members of the Scottish Branch.

A denial that the Jarrow galvanising works are to be closed is contained in a statement issued by Thos. W. Ward, Limited, of Sheffield, who at present control the Jarrow plant.

The Manufacture of Portland Cement

(*Concluded from page* 248.)

break down the coal, flinging it outwards; the air stream draws it round the edge of the rotor disc, which is fitted with projections which pass between pegs on the stator. It is at this stage that the coal is finally ground, after which it is blown direct into the kiln by the fan incorporated in the machine.

The latest machine (Fig. 6) is a drying drum and tube mill in one unit, combining the reliability and low upkeep costs which are characteristic of these two machines as separate units; drying and grinding, however, being carried out in one unit with consequent saving due to the elimination of one unit altogether and its attendant elevating and conveying machinery, as well as saving space, foundations and power. The combined machine has been built and is operated in such a way that the tube mill section does not have to contend with moisture, always a trouble in tube mills designed for dry grinding. The machine consists of a tube mill following the usual practice of having two or more chambers, upon the inlet trunnion of which is cantilevered a cylindrical drying chamber, fitted inside with other cylinders or lifting and scooping devices arranged to expose as large an area of coal as possible at any given time. Hot air may be drawn from the kiln or a separate furnace by means of a fan, the heated air entering the drying chamber with the coal, some of which, if dry and fine enough, is picked up and taken straight through the machine. As the coal is tumbled in the drying chamber some dust will be released and is at once picked up by the air stream, which also collects the dust produced in the tube mill section. The coal dust and air leave through the mill trunnion to a separator where the coarse particles are trapped and returned to the mill, while the coal of sufficient fineness passes to a cyclone where it is collected and put into storage bunkers. The air from the cyclone can pass to the kiln coal-firing fan, in which case there is no loss of dust, as the whole system is under suction and the machinery and buildings are kept very clean.

In concluding this Paper the author wishes to thank the following firms for use of blocks for illustrations:—Stothert & Pitt, Limited, The British Rema Manufacturing Company, Limited, F. L. Smidth & Company, Limited, and Miag A/G, Brunswick.

Catalogue Received

Electric Furnaces. An eight-page well-illustrated brochure received from Birmingham Electric Furnaces, Limited, Birlec Works, Tyburn Road, Erdington, Birmingham 9, serves to announce that this company has taken over the British Dominion (except Canada) and European rights for the sale of the "Lectromelt" direct-arc melting furnace. Unquestionably this furnace does make a number of departures of radical character compared with the war-time equipment. In one model the roof is elevated to facilitate rapid charging. The reviewer once questioned the advisability of this owing to the cooling effect on the refractories, but he received the common-sense answer that the filling was so rapid that no time was allowed for cooling down, as it takes but one minute, and the "power off" to "power on" is a matter of but 10 min. maximum. The electrode control is also of a novel character. In the brochure are four excellent diagrams showing the construction, whilst a table sets out the k.v.a. rating, the hourly output, and the average and maximum charges for seven standardised models. These reveal an exceptional rapidity of working which brings about a number of consequential economies. We advise our readers to familiarise themselves with this plant by sending for this brochure, which is numbered 42.

Foundry Costing

VIEWS OF WEST RIDING OF YORKSHIRE AND EAST MIDLANDS FOUNDRYMEN

The February meeting of the West Riding of Yorkshire Branch of the Institute of British Foundrymen, held at Bradford Technical College, was devoted to a consideration of the Report of the Institute's Costing Sub-Committee and an expression of views thereon by members of the industry in West Yorkshire. The preliminary findings of the Sub-Committee were given in summary form in a Paper by Mr. W. A. Hodson, of Leyland, Lancashire, a member of the Costing Sub-Committee.

The BRANCH-PRESIDENT (Mr. F. K. Neath), introducing the speaker, said that members would realise that the Institute was a technical and not a trade body, and they knew it was not their function, in that organisation, to deal too closely with matters of business costing. The question of costings, however, in its relation to the working side of a foundry—of materials used and labour applied—was of the utmost importance because the practical work was of little use unless adequate steps were taken to make it profitable. Many foundrymen were in a position of responsibility involving the determination of costs, and it was felt by the Institute that there must be some common points in which foundrymen were concerned in this aspect of their job. The Institute had appointed a special Sub-Committee who had entered very carefully into the matter and issued an interim report and now, before producing anything in any final form, that Committee invited and desired the views, opinions or criticisms of the members of the Institute's Branches. The importance of the subject could hardly be denied by anybody. It had been said that a sound casting was highly important, but when the running of a foundry was referred to, a sound costing system was even more important.

MR. W. A. HODSON, in presenting the Paper, which has been previously published in THE FOUNDRY TRADE JOURNAL, said he felt that every member of the Institute was agreed that a good costing system was vitally important to every business. There were, one feared, many firms who had got into difficulties and who to-day might have been in happier positions if they had paid closer attention to their costs of production. If it could be taken as certain that every member of the Institute had carefully read the recommendations published in THE FOUNDRY TRADE JOURNAL of December 27 last, it would be most helpful, and productive of a fruitful discussion. As, however, the publication was made at Christmas time it was likely that a number of members had not read the Paper, and therefore he would read the report and hear the objections, if any, of the members present.

DISCUSSION

Suicidal Price Cutting

Following Mr. Hodson's reading of the Paper, the PRESIDENT, commenting on the highly interesting nature of the address and the great deal of mental arithmetic which must have been involved in the production of the Committee's report, read a letter from Mr. F. W. Rowe, chief metallurgist and head of foundries for David Brown & Sons, Limited, Huddersfield, who unfortunately was unable to be present at the meeting.

MR. ROWE had written:

"The subject of costing is one which I feel is of very vital importance to the whole foundry industry. In fact, I personally would go so far as to say there can be no firmly founded prosperity in the industry until every founder in the country adopts uniform and accurate methods of costing. It only means one or two founders in each district with inaccurate costing methods, and who are unconsciously heading for bankruptcy, to jeopardise seriously the prosperity of the other foundries in that district. It is not so much the work that they get at uneconomic prices, but largely the weapon they place in unscrupulous buyers' hands to lever down a fair economic price for castings to one which gives an uneconomic return to the founder. This, taken *in toto*, leaves the whole industry in a precarious position and the money which should be there is not available for new plant, modernisation, investigation of new methods and research. I cannot too strongly urge my fellow members of the Institute of British Foundrymen to give this subject of accurate costing their fullest attention. This interest should also be shown in a practical form by giving the Sub-Committee of the Institute on costing every possible assistance and co-operation, and give the uniform methods—which we know will at the best be merely a compromise between everyone's ideas—a chance to make good in their own works. No perfect system, we appreciate, can be evolved which will satisfy every type of foundry, but surely for the sake of uniformity and the tremendous benefits that will accrue therefrom, we can all sink our personal fads and foibles."

Home Scrap Debited at Current Prices

MR. W. G. THORNTON (Past-President of the Branch) said he felt the accumulation of home scrap was liable to fill the stockyard with home scrap at fictitious values which eventually might work out more costly than bought scrap. His idea was that it should be returned to the yard at the value of such scrap at that date. It might increase the metal cost at spout, but it was that cost which they needed to know. He agreed with the Committee as to the helpfulness of special irons, but for everyday purposes in the average foundry he felt it desirable, as stated, to return home scrap to the yard at current purchase value.

The Case of a New Foundry

MR. HODSON, in reply, said, supposing one was opening a new foundry and had no home scrap, one would have to buy pig-iron and scrap. If one charged 50-50, then one paid, say, £3 15s. for pig and £2 12s. 6d. for the scrap. When that was in the ladle, what had it cost? The cost of that metal, in castings or as scrap, was the average cost of the purchased metal. No wise foundryman would consider extensive stocking of his own scrap and purchasing scrap from outside. Many foundrymen, no doubt, would say their own scrap was better than could be bought, but in any case a man would feel he must use it rather than let it accumulate. Every foundryman was justified in valuing his own scrap at the average price of the metal he had bought.

MR. THORNTON said he was not so much concerned with starting a new foundry as running existing foundries of a general character. In the case of a foundry that was closing down, what was going to happen then? Any accumulated scrap would be sold at current purchase value, not at the value at which it was stocked.

MR. HODSON said their main concern, after all, was with the cost of a going concern, not with the financial value of anything in stock when a foundry was closing.

The BRANCH-PRESIDENT thought the Sub-Committee's policy implied that every day all runners and risers, etc., should be weighed out, and weighed in next day to ascertain the weight of metal going into the castings.

MR. HODSON pointed out that if foundrymen were to arrive at a proper figure, they must have correct weights. It might not be essential to do as the chairman said, but it was certainly desirable that correct weights should be recorded.

The BRANCH-PRESIDENT said that runners and risers should be regarded as part of the plant, because they were always there whatever other scrap there might be. To his mind, one should cost the home scrap once a year, say on January 1.

MR. HANSON said the cost of a job had to be inclusive of everything. The scrap had become of less value, and it must bear that cost. It did not appear to him a big bone of contention to support the average price. When one initiated a foundry, the first cost price would be lower than afterwards, and he did not think one could support the average charge on that account. He considered that the home scrap price should be the market price.

Taking Care of Various Mixtures

MR. H. FORREST asked how Mr. Hodson would allocate melting costs in a foundry with an average of six or seven different mixtures each day and a similar variation in cost of working times.

Replying, MR. HODSON suggested that the cost of melting 1 ton of one mixture was much the same as melting 1 ton of another mixture. It would be very difficult to attempt to allocate a melting cost against any particular mixture, and, in his view, the correct method to adopt would be to take an average melting-cost figure over any given period, applying that figure to the metal cost to arrive at the cost of metal at the spout or in the ladle.

How to Adopt the System

MR. FORREST said if anyone thought of starting this system, what period would Mr. Hodson suggest for them to go back over their existing records to find the amount of wages, etc., to arrive at the figure of incidentals to make up the on-costs? If it were taken over the past year, for instance, when times were rather bad, the proportion of on-costs would be heavier than to-day, when conditions are better.

MR. HODSON replied that he thought the Committee would recommend as a general guide a twelve-month period, though he agreed some regard must be paid to circumstances. The fixed standing charges per week or month remained fairly steady whatever variation occurred in production, and provided a fairly stable figure as a start. If there had been a period when things were not very satisfactory, and might not be regarded as a reliable guide over twelve months, there was no reason why a three- or six-month period should not be taken for fluctuating charges. It was difficult to give a definite period, because much depended on the circumstances of the particular foundry concerned.

MR. S. CARTER suggested estimating the probable normal turnover and dividing it by the fixed expenses, to give a fairly good basic figure on which to start the on-costs.

MR. FORREST said his point was that perhaps the system allowed too much latitude. He felt that the on-cost period might be shortened perhaps even to the preceding month.

MR. HODSON said, if the fixed charges, which had to be carried every month of the year, were ascertained and recorded, the fluctuating charges could be taken monthly or even weekly if desired, but he would recommend a more lengthy period as providing a more satisfactory figure. On-cost figures at the best were an estimate for the future, and there was no guarantee that the on-costs for the next period would be the same as in the period on which the estimate was made, so the longer the period, within reason, the better the average.

From Percentage to Direct Costs

MR. H. A. MCCOLL (Bradford Technical College) said he felt that in the list of on-cost items enumerated by Mr. Hodson there were some that might advisedly be taken out of the percentage system and allocated on a tonnage basis, as, for instance, coal dust, sand, blacking, etc. The

heavier work took more of these things than the light castings, and it might, therefore, be better to estimate such items on a tonnage basis.

MR. HODSON said the suggestion was a good one. He thanked Mr. McColl, and would make a note of it for the Committee's attention. In America, where they had different organisations for the various sections of the trade, the steel-foundries used a tonnage-cum-percentage method, but the grey-iron section used the percentage. The Sub-Committee had given consideration to this matter, and eventually decided that the percentage method was the better. The point, indeed, was the subject of comment by the Editor of THE FOUNDRY TRADE JOURNAL when the Sub-Committee's Report was issued.

MR. J. SMITH remarked that if a foundry took its costings over a slack period, the on-costs thus ascertained would raise the price of the metal per ton at the spout. It had to be remembered that that would determine the selling price when selling in the open market, perhaps against another man who had had a good period when making his costs. Such circumstances would make the former man's position rather awkward.

MR. HODSON suggested that that was a difficulty many people had to contend with, but it was partly overcome by the use of "normal on-costs." This was a matter which would probably be dealt with at a later stage, when the question of estimates would be considered.

Simplified Recommendations

MR. A. S. WORCESTER (Huddersfield, Past-Branch-President) said, to his mind, the work of this Sub-Committee was a very fine effort for the good of the industry, and he believed they would realise it more as time went by. There was no denying that in the Yorkshire area—whatever might be the case elsewhere—they obtained some of the most ridiculous ultimate figures one could imagine. The need for a careful system of costing was probably more obvious than anything in the foundry trade to-day, and he hoped the Sub-Committee of the Institute would be able to condense their ultimate recommendations into some sort of concise form which could be issued to the members for ready reference. In regard to the question of values as against costs, obviously one had to determine costs if it was desired to obtain values. Personally, he felt that moulding costs could be assessed by way of questions such as thickness, floor space, etc., but they could all adapt to their own circumstances the methods suggested by the Committee. For the ordinary foundry manager or foreman the task of arriving at overheads was very difficult in some cases where there was a lack of complete data from the heads of the firm. He did, however, consider that when a foundry had been in existence some years, they could all allocate their average fixed overheads with reasonable certainty. In the average jobbing foundry these would probably work out at about 20 per cent. To Mr. Worcester's mind, the efforts of the Sub-Committee would prove a godsend to the industry.

MR. HODSON, thanking Mr. Worcester for his observations, said that Committee must, of course, progress stage by stage. They offered these recommendations and wanted the views and opinions of the members of the Institute, and the Committee would be prepared to amend their recommendations with the help of the members generally. When they had completed the Melting and Moulding Sections they would proceed, and, in fact, were proceeding, with the other sections of the foundry, and eventually, he believed, they would issue the final recommendations in concise and handy book form.

Cost of Tackle

MR. CARTER raised a question as to cost of tackle. When Mr. Hodson spoke of charging tackle at cost did that include overheads?

MR. HODSON: No—labour and materials.

MR. CARTER observed that if there were a job that took 8 hrs. and one had to spend 4 hrs. previously in preparing tackle, apparently the Committee would work out the cost on that at 8 hrs., whereas his personal notion would be to take it at 12.

MR. HODSON pointed out that the 4 hrs. represented a non-productive expense, and when the job was completed one might have tackle left for use on other occasions. Was it, therefore, quite right to charge it up to the one job? The Committee advocated the general principle of charging everything to the job so far as reasonably could be done. Where the tackle was definitely for one job only, the job obviously should bear the cost, but where, as in many cases, the tackle—though prepared originally for one specific job—became part of the loose foundry tackle then the cost of such tackle could hardly be charged to the one job in respect of which it was made. If a job incurred special expense the charge of that expense should, normally, be against the job concerned, and Mr. Carter would be quite justified in charging 12 hrs. productive time if the tackle could not be used again. A great deal depended on the circumstances and on the judgment as to whether one could reasonably include the cost of the tackle in the cost of the job.

MR. THORNTON agreed with Mr. Worcester that the system as proposed by the Committee, to be of practical services to the average foundryman, would need to be crystallised as a concise summary of recommendations. There were at present, he felt, too many sections of overheads to be of practical value to the average jobbing foundryman, and he suggested that many items could be put into melting costs. As a simple method, he would include in melting costs all the new sand bought, all the labour for mixing sand, all power and heat and water. That would cut out about five items from the establishment charges.

The BRANCH-PRESIDENT said so far as concerned the West Riding of Yorkshire, it was a district of jobbing ironfounders and it was quite clear that they would like the Committee to bear in mind particularly the needs and requirements of the jobbing founder, because he was the man who most seriously needed this development of costing system. In the jobbing foundry the simpler the overheads list the better.

Vote of Thanks

MR. S. W. WISE (hon. secretary) proposed a vote of thanks to Mr. Hodson for his visit and address, and through him to the Sub-Committee for its valuable voluntary labours on behalf of the members of the Institute. It was, he said, easy to realise that the Committee had undertaken an arduous and difficult task, and the West Riding Branch wished them a completely successful outcome.

MR. W. FEARNSIDE, seconding, said there was no doubt at all this was a very difficult and intricate problem, and one in which jobbing foundrymen in particular were much concerned, especially in the question as to schedule prices. One could not, after all, estimate the cost of a job merely by its weight.

DISCUSSION IN DERBY

Mr. C. W. Bigg, Vice-President of the Institute, presented the Preliminary Report on Costing to the East Midlands Branch of the Institute of British Foundrymen at Derby Technical College. After dealing with the first part of the Paper on metal costs, Mr. Bigg referred to recent discussions in THE FOUNDRY TRADE JOURNAL, and noted that controversy still seemed to be centred around the cost of "home scrap." He said he hoped to make this clear to the meeting before proceeding with the main part of the Paper, and invited questions on the home scrap and melting cost tables, which he answered and illustrated on the blackboard. He then proceeded with the remainder of the Paper dealing with moulding department costs.

Home Scrap

MR. HARBACH, who opened the discussion, raised the question of home scrap, and asked why the committee had definitely put aside the question of charging home scrap at purchase scrap price. He was thinking of the difficulty of correctly charging home scrap when one had varying mixtures.

MR. BIGG replied that the committee were definitely of the opinion that home scrap should be charged at the actual cost as shown in the table. He agreed that if a firm closed down and had to sell the scrap, it would only realise market price, but one did not make scrap to sell in that manner, and as it was to be used in the foundry it should bear the price that it actually cost the foundry. As regards varying mixtures, that could easily be taken care of if the different types of scrap were segregated.

MR. P. A. RUSSELL said he would criticise the quantities in the tables shown. The first table showed 1 ton of pig to ½ ton of scrap, and the second table showed 50 per cent. pig and 50 per cent. scrap. He thought the tables should be inter-related. The second table should show comparative figures. As regards the principle of arriving at the price of home scrap, he agreed.

Milling Losses

MR. HOLLAND asked for some explanation of the melting losses, since the cost shown was on 2 tons, for which 2 tons 2 cwts. would have to be melted.

MR. BIGG said the chart did not show 2 tons 2 cwts. It referred to melting 2 tons only. The result would be 1 ton of castings, and 18 cwts. of scrap, but 2 tons should be charged, then showing a melting loss of 2 cwts., or 5 per cent. The figures referred to a 50 per cent. castings to melt ratio.

MR. W. T. EVANS asked Mr. Bigg how the system would answer for a foundry which might run, say, 15 tons of metal one day, and only 1 ton on another day.

MR. BIGG said for the foundry which one day melted 1 ton, and another day possibly 15 tons, he did not know what system could be suggested. It was obviously uneconomic. As regards Mr. Evans' other remarks, he referred to the part of the discussion at Manchester, quoted in the January 30 issue of THE FOUNDRY TRADE JOURNAL, where a member told of an interview between a seller of castings and a buyer. The seller, on being asked to quote for a series of castings, had inquired his competitor's price and had offered to take them at 6d, less per cwt. He (Mr. Bigg) did not think this was much exaggerated, but he could not blame the buyer for taking advantage of the foundryman's lack of knowledge of his job. It was up to the foundryman to protect himself. How else could he estimate a job correctly, than by having proper costs on which to base his estimate? If costs were known, the majority of foundrymen would quote sensible prices. So far as this discussion was concerned profits did not matter, costs were the important factor, and he would emphasise the value of a costing system as an aid to efficiency.

Importance of Factual Oncosts

MR. R. SPRIGGS said he was glad to see that Mr. Bigg gave no encouragement for juggling with oncosts. He referred to certain classes of castings made at very low prices per ton, which he thought were being carried by better lines. Mr. Bigg had pointed out that that process would not do. There was the type of buyer who was always on the look-out for the cheap supplier. That sort of buyer should not disturb the supplier. The time would come when that buyer would run short of supplies and would have to approach the suppliers. Mr. Bigg had appeared cold-blooded on the question of oncosts, but he would like to ask the direct question: Would Mr. Bigg vary oncosts on certain classes of castings, irrespective of what those jobs should carry?

MR. BIGG said he would reply to the last question first. There was only one cost he would take, and that was the right one. If a certain type of casting was expected to be purchased at an uneconomic figure, he would leave it for

someone else to supply. There may be in the minds of some foundrymen a prejudice against costs as being simply figures causing added expense. If those cost figures were so compiled as to be facts, then the foundryman would find them a paying investment, and the expense was not nearly so large as some seemed to think. He went to the cost book to see how things were going, and he got most valuable pointers from the cost book. The foundry foreman could utilise costs to a very great extent and with great value to him. If one built up a system with that in view, one must have facts, and not faked facts. One had to make an honest attempt to get every factor on the shop logged somewhere, in a direct way if possible. If one did a job at a loss, it was essential to know it. What was the system in some places? They went through a year's trading, then the books were audited, and some three months later they knew whether a profit or loss has been made. What was the use of that?

Overheads on Wage Hours

A VISITOR queried the advisability of allocating oncosts as a percentage on direct wages. He favoured the method of a basis of oncosts on direct wage hours. His objection to the suggested method was that where jobs were sometimes made by full-rate men and sometimes by youths with a lower rate of pay, there was variation of cost when applying oncost on to the wage.

MR. BIGG pointed out that the committee favoured the direct wage as the simpler, but as the wages were usually closely allied to the hours there was not a very great difference. In connection with the point of apprentice labour, where this was not constant on a particular job, care would be necessary when the costs were used for a new estimate, as if a man was put on the job the next time the costs would not tally.

The VISITOR replied that for estimating one would have to take a man's rate, but for costs it was the correct cost that was required, and, therefore, if a job was made by an apprentice the system would not give correct figures. As an instance, he suggested that if a job was made in 200 hours and the full rate was, say, 1s. per hr., the direct wage would be 200s. Supposing oncosts were 100 per cent., that would be 200s. If the job was made by a low-rated apprentice, the oncost on direct wage would be too low. On his method the oncost would be based on direct hours, so that if the oncost was, say, 1s. per hr., the job would carry full oncost, irrespective of the rate of wages paid for different grades of labour.

MR. BIGG thanked the speaker for this point. As a committee, they were finding it easier to obtain evidence from the repetition people than from the jobbing shops, and this seemed a point likely to crop up in such shops.

MR. HARBACH suggested that this might be overcome by allowing double overheads on apprentice rates.

MR. BIGG agreed that the question might be solved by adopting an increased overhead rate as suggested.

MR. P. A. RUSSELL said that if the proportion of youth labour in the shop was kept to a constant of the total direct wages, he could not see there would be any difficulty.

Box Part Costs

MR. SPRIGGS asked whether it was fair to charge the cost of box parts to the cost of the job as they would no doubt go back to the cupola.

MR. BIGG said that if one knew that the box parts were going back to the cupola as scrap, then the scrap value could be credited. The point of the committee was that special box parts must be charged to the special job. Supposing a firm had five customers, and a sixth customer came along and special tackle had to be put down for this customer, it would not be just to make the five customers bear a portion of the cost of that tackle.

A vote of thanks was accorded to Mr. Bigg and the Costing Sub-Committee by MR. H. BUNTING, seconded by MR. F. BUTTERS.

Foundry Trades Equipment and Supplies Association

The annual meeting of the Association was held at the Hotel Metropole, London, last Thursday, Mr. G. T. Lunt presiding. Mr. K. W. Bridges, the honorary secretary, submitted the annual report, of which we print below an abstract.

ANNUAL REPORT, YEAR ENDING DECEMBER 31, 1935

It is satisfactory to note that the falling-off in membership reported twelve months ago has been arrested, and the number of members on the register at the date of closing this report is the same as of the previous year, namely, 24. During the year also we have been successful in collecting certain back subscriptions, so that our subscription revenue shows a larger sum than in 1934.

The income and expenditure account shows this year a favourable balance as compared with a few pounds loss on the last occasion. This is to be accounted for largely by the fact that, at his own suggestion, the hon. secretary's honorarium was decreased at the last annual general meeting.

The outstanding interest and activity of the Association for the year under review was the organisation of the Foundry Trades' Exhibition, held in conjunction with the Shipping, Engineering and Machinery Exhibition at Olympia in September. Whilst it seems to be the general opinion that the co-operation with the larger exhibition proved of benefit to members taking space, the support from members and manufacturers of foundry equipment generally was not as extensive as could have been wished, and it is certainly our hope that on another occasion, if this experiment is repeated, it will commend itself to a larger number of exhibitors of foundry equipment.

Speaking at the inaugural luncheon of the exhibition, the President made the suggestion that in future years an attempt should be made to induce makers of castings to stage a comprehensive exhibit, and thus form a link between the Foundry Supplies Section and the Engineering Exhibition itself. It was pointed out that a great number of the visitors to the exhibition are engineers, who purchase large quantities of castings. Several foundry owners have commented favourably on the suggestion, and the matter will engage the attention of the Association when contemplating another exhibition.

At Olympia it was possible to maintain the most friendly relations with the Institute of British Foundrymen, the British Cast Iron Research Association, and The Institute of Vitreous Enamellers. All these three bodies paid official visits at the invitation of the organisers, who also fitted up a rest room for the benefit of the first-named and arranged a display for the second in conjunction with the Department of Scientific and Industrial Research.

Round about the time of the exhibition there took place a Foundry Congress in Brussels, arranged by the Association Technique de Fonderie. It was found possible to avoid a complete overlap in the two events, so as to leave the first few days free for delegates to the Congress to visit the exhibition before crossing over. The authorities of the Congress also did us the honour of inviting our President to read a Paper at their first technical session, which he duly did.

Once again we established co-operation with the Institute of British Foundrymen by a joint contribution to the funds of their Annual Convention at Sheffield. On this occasion members were asked to guarantee their amounts and to pay up in the first instance 50 per cent. only of their total guarantee.

Finally, we feel that the Association is still performing those functions which it mainly set out to do, and we trust that members will continue to be satisfied to make their small annual financial contribution, and, wherever possible, to induce other eligible firms to join us, as by virtue of the exhibition arrangements alone we hope to continue to do good service to the members and to the trade as a whole.

The report is signed by G. T. Lunt, President; and K. W. Bridges, hon. secretary.

After considerable discussion it was decided to support the next Shipping, Engineering and Machinery Exhibition, to be held in September, 1937, at Olympia. The retiring officers were all re-elected, and Mr. Norman Winter was invited to fill a vacancy on the Council.

New Zealand Steelworks Project

£3,000,000 WORKS PROPOSED

A proposal to establish steelworks in New Zealand is being considered by the Government of that Dominion. The plan is part of a large-scale scheme of the new Labour Government for the relief of unemployment.

The suggestion is to establish the works at Onekaka, Nelson, where there are already small works developed by the Pacific Steel Company, an organisation which has spent some £10,000 on assay work and prospecting in the locality with Government assistance. The proposed works would be on a large scale, costing up to £3,000,000 to establish.

In announcing the plan, the Minister of Labour, the Hon. T. Armstrong, said experts had expressed themselves as confident that the works could produce all the steel the Dominion required. He was inclined to the view that the work should be taken over by the State, and not just proceed with Government assistance.

The idea has met with severe criticism from Chambers of Commerce, which maintain that works could not be established on an economic basis in New Zealand at present owing to the wide variety of sizes and shapes required, and the comparatively small quantities that would be used. They claim that large and expensive plant would be needed, and it would lie idle for a great part of the year. Further, they allege, the cost of production would be too high.

A Ministerial reply states that the project is being very fully investigated by the best experts available, and a great deal of work would be done before the examination was brought to a conclusion and a report presented to the Government. The financial aspect was being thoroughly looked into, and the results to date could be counted encouraging.

Should the works be founded, the industry will be one of the largest in New Zealand.

Publication Received

A Directory of Coventry Manufacturers. Published by the Corporation of Coventry Development Section, Council House, Coventry. Price 2s. 6d.

We regard this publication as the most intelligently arranged piece of propaganda ever issued by a district development association. Not only does it tell the reader just what the City offers by way of public service, but it gives a proper statement of the potentialities of the district as a consuming and distributing centre, the quantity and type of skilled labour likely to be found and the nature of the local competition. The last factor is given in great detail in proper directory form, each firm being listed and followed by a list of products manufactured in Coventry. The type is relieved by a series of excellent illustrations of local workshops and typical productions.

THE SOUTH AFRICAN RAILWAYS have placed orders for locomotives to the value of over £250,000 with German makers. The total order is for 24 heavy passenger locomotives and tenders.

CUMMING'S BLACKINGS ARE THE BEST

Extract from daily report by one of our travellers:—

January 9th, 1936.

Mr. C..... said,

"I shall send on to you every time. Since we adopted your Blacking the skin of our castings has improved by 100 per cent. Our customers were the first to notice it."

NEED WE SAY MORE

All our productions are carefully graded, tested and manufactured.

WM. CUMMING & CO., LTD.

KELVINVALE MILLS, Maryhill, Glasgow, N.W.
SUNNYSIDE BLACKING MILLS, Falkirk.
WHITTINGTON MILLS, Chesterfield.
DEEPFIELDS MILLS, Bilston.
STATION CHAMBERS, Middlesbrough.

This Week's News in Brief

Trade Talk

TAYLOR & CHALLEN, LIMITED, Birmingham, are planning an extension of their foundry.

RENFREW PLANS COMMITTEE have approved plans for a new steel foundry and tensile test house at Porterfield for Babcock & Wilcox, Limited.

WILLIAM GRAY & COMPANY, LIMITED, West Hartlepool, have received a repeat order from Cockerline & Company, Hull, for a 9,000-ton cargo steamer.

PLANS FOR THE reconstruction of part of the works of J. Fyfe Donald & Company, Limited, ironfounders, Johnstone, near Glasgow, have been passed by the local Dean of Guild Court.

THE INSTITUTION OF CHEMICAL ENGINEERS and the Chemical Engineering Group (Society of Chemical Industry) have removed their offices to 56, Victoria Street, London, S.W.1. The new telephone number is Victoria 1410.

AT A MEETING of the Falkirk Dean of Guild Court, permission was granted to R. & A. Main, Limited, to make an extension, costing about £2,500, to their enamelling shop and store at the Gothic Iron Works, Camelon, Falkirk.

WHEN MR. G. C. USHER, managing director of the International Combustion, Limited, opened the club and institute at the Derby works last Saturday, he assured the employees of regular work for the next few years.

HEAD, WRIGHTSON & COMPANY, LIMITED, of Thornaby-on-Tees, have received a repeat order for 18 tons of their special "Abednego" heat-resisting steel. This special alloy steel is for use in a large oil-refining plant in Persia.

SUBJECT TO THE SETTLEMENT of certain points of detail, the Admiralty have decided to entrust the construction of the depôt ship for submarines, H.M.S. "Maidstone," of the 1935 programme, to John Brown & Company, Limited, of Clydebank.

A NEW PRIVATE COMPANY, under the style of Cockburn Bros. (Govan), Limited, 182, Helen Street, Glasgow, S.W.1, has been registered with capital of £3,000, to acquire and carry on the business of Cockburn Bros., tubular barrow makers.

JOHN READHEAD & SONS, LIMITED, South Shields, have booked an order for a 9,000-ton cargo ship from Andrew Weir & Company, London. The firm now has three vessels, representing 28,000 tons of shipping, on order. The machinery in every case will be supplied by Readheads.

IN THE ANNUAL REPORT of the Committee of Management of the Benevolent Fund of the Institution of Mechanical Engineers, it is revealed that a gift of £1,000 was received from Sir Robert A. Hadfield, Bt., F.R.S., in response to a special Jubilee Appeal made to the members of the Institution by the President.

THE TURKISH GOVERNMENT is endeavouring to obtain a loan of £T10,000,000 from a firm of bankers in Berlin in order to establish an iron industry in Turkey. This report, not yet officially confirmed, states that development is part of the scheme to introduce a five-year plan, in emulation of that of Soviet Russia, for the building up of an industrial system in Turkey.

DR. ANDREW M'CANCE was re-elected President of the West of Scotland Iron and Steel Institute at a meeting in the Royal Technical College, Glasgow, on March 13. This is Dr. M'Cance's fourth term of the presidency. Other office-bearers were appointed as follow:—Vice-Presidents, Prof. R. H. Hay and Mr. James Bryden; hon. treasurer, Mr. Douglas A. MacCallum, and members of council, Messrs. W. H. Cathcart, W. B. Mitchell, T. M. Service and D. J. Barr.

GREETINGS BY RADIO were exchanged between Qualcast, Limited, of Derby, and Qualcast, Limited, of Melbourne, Australia, during the firm's annual dinner, held on March 21, in the Drill Hall, Derby. At 8.15 p.m. Mr. V. Jobson, managing director in Derby, called Major R. A. Briggs, managing director in Australia, and an exchange of greetings took place. One of the guests, Mrs. Henning, spoke to her son, who is employed at the Qualcast works in Australia.

THE TYNE'S CLAIM to build the proposed sister ship to the "Queen Mary" was stressed at the annual dinner of the North-Eastern Iron and Steel Stockholders' Association, at Newcastle-upon-Tyne, on March 20. Mr. John W. Nicholls (Northern Guild of Commerce), proposing the toast of "The Iron and Steel Trade," said that the Clyde had built the first ship, and it was now the Tyne's turn. Mr. Alfred J. Raine, director of the Delta Iron Works, congratulated the Clyde on building the "Queen Mary," but remarked that the Tyne had a berth big enough to accommodate a vessel of this size.

AUTHORITY HAS BEEN GIVEN by the British railways for the construction of 944 locomotives, 2,447 carriages and 25,711 wagons. This represents a large increase on last season's programmes. Orders for 379 locomotives have been placed with British locomotive manufacturing firms. The G.W.R. is constructing 225 locomotives, the L.N.E.R. is building 207 engines under a two years' programme, the L.M.S. is building 133 locomotives and 111 locomotive boilers in its workshops, and 369 engines are being obtained from contractors; while for the Southern several "mixed" traffic locomotives are to be built at Eastleigh, and other types will be passed through the workshops.

THE IMPORT DUTIES ADVISORY COMMITTEE give notice that they have under consideration applications for an increase in the import duties on powdered graphite, plumbago and blacklead, that is to say, graphite, plumbago and blacklead whereof more than 60 per cent. by weight passes through a No. 100 British Standards Institution sieve or more than 20 per cent. by weight passes through a No. 150 British Standards Institution sieve. Any representations which interested parties may desire to make should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than April 9, 1936.

THE REPORT of the directors of the Millom & Askam Hematite Iron Company, Limited, states that the new No. 3 blast furnace, which was put into blast last year, has proved to be very successful, and has given record outputs, while the new No. 2 blast furnace is nearing completion. The ore-sintering plant is now completed and in operation, and the current year should show many advantages from its installation. The results of Millom for the year were impaired by reason of the reconstruction in progress, which naturally handicapped operations, but as the rebuilding programme is now nearing completion, the result of more efficient working will show in the current and succeeding years.

Contracts Open

Armagh, March 31.—Cast-iron and lead pipes, for the Urban District Council. Mr. V. M. Conran, town clerk.

Dundee, April 7.—General engineering stores, for the Electricity Department. Mr. D. H. Bishop, general manager, Electricity Department, Dudhope Crescent Road.

Chippenham, March 31.—3,280 yds. of 10-in. dia. coated cast-iron pipes, for the Town Council. Mr. A. E. Adams, borough engineer, High Street, Chippenham, Wilts. (Fee £2 2s., returnable.)

Exeter, March 30.—Electrically-driven pumping plant, including pump, motor, starting gear, piping, valves, etc., for the Town Council. Mr. R. H. Dymond, city engineer, Municipal Offices. (Fee £2, returnable.)

Llandebie, April 3.—2,200 yds. of 3-in. cast-iron pipes and 2,500 yds. of 1-in. and ½-in. wrought-iron tubes, for the Llandilo Rural District Council. Mr. H. Herbert & Company, College Street, Ammanford. (Fee £2 2s., returnable.)

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Slough Metals, Limited.—Capital, £4,000. Manufacturers, founders, etc., of aluminium and other metals. Subscribers: B. B. Limbrey, 3-4, Clement's Inn, London, W.C.2; V. A. Braune.

Broadheath Aluminium Bronze Company, Limited, Balfour Road, Broadheath, near Manchester.—Capital, £500. Permanent directors: F. N. Singleton, R. Pearson, and C. S. Norbury.

Personal

MISS M. BISHOP, a typist with the North British Steel Foundry, Limited, Bathgate, has been presented with a cheque from the directors, and a case of cutlery from the staff, on the occasion of her marriage.

MR. F. C. WILLIAMS, secretary of the Transvaal Chamber of Industries, has resigned his position to take up the secretaryship of the Transvaal Engineering and Allied Industries' Federation, which recently decided to leave the Transvaal Chamber of Industries. Mr. Williams, who was born in Hereford, has been prominently identified with the industrial life of South Africa for many years.

AT THE ANNUAL MEETING of the Manchester Association of Engineers, to be held to-morrow (Friday), it will be proposed that, in celebration of the 80th anniversary of the Association, the following members, who have been members of the Association for fifty years or over, be made honorary life members: Mr. Isaac Simpson, Mr. G. Kiernan, Mr. Hans Renold, Mr. S. H. Brooks, Mr. F. Robinson, Mr. R. Taylor and Mr. F. W. Reed.

Obituary

MR. T. M. CREESE, senior partner of H. J. Creese & Sons, ironfounders, of Chester Street, Leicester, died recently, in his 76th year. He began business in Leicester 60 years ago, with his father, the late Mr. H. J. Creese. The business will be carried on by his son, Mr. H. J. Creese, and Mr. W. H. Creese, brother of the deceased.

THE DEATH has occurred, in his 80th year, of Mr. Frederick Chambers, of Sandiacre. For many years Mr. Chambers was a director and foundry manager of the Stanton Ironworks Company, Limited. He retired from the position of works manager 15 years ago, but continued to act as a director of the company until a year ago.

Forthcoming Events

MARCH 27.

Manchester Association of Engineers:—Annual General Meeting; "Modern Gasworks Practice," Paper by E. W. Smith, D.Sc., at the Engineers' Club, Albert Square, Manchester, at 7.15 p.m.

APRIL 3.

Institution of Mechanical Engineers:—An informal meeting, at Storey's Gate, St. James's Park, London, S.W.1, at 7 p.m.

Institute of Metals

MARCH 31.

Birmingham Section:—Annual Meeting; Chairman's Address, by Maurice Cook, Ph.D., M.Sc., at James Watt Memorial Institute, Birmingham, at 7 p.m.

APRIL 2.

Birmingham Section:—"Recent Developments in the Casting of High-Strength Zinc-Base Alloys," Paper by A. H. Mundey, at James Watt Memorial Institute, Birmingham, at 7 p.m.

APRIL 7.

North-East Coast Section:—Annual Meeting; Demonstration of High-Frequency Induction Furnace, at Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-upon-Tyne, at 7.30 p.m.

Institute of British Foundrymen

MARCH 28.

Newcastle-upon-Tyne Branch:—Annual General Meeting, at Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6.15 p.m.

East Midlands Branch:—Annual Meeting; Members Problems, at the Technical College, Derby, at 6 p.m.

APRIL 1.

London Branch:—Annual Meeting; Short Paper Competition, at Charing Cross Hotel, Charing Cross, W.C.2, at 8 p.m.

APRIL 3.

Birmingham, Coventry and West Midlands Branch:—Annual Meeting; Short Paper Competition, at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.30 p.m.

APRIL 4.

East Midlands Branch (Lincolnshire Section):—Annual Meeting, at the Technical College, Monks Road, Lincoln, at 7 p.m.

Lancashire Branch:—Annual Meeting; "Foundry Refractories," Paper by W. J. Rees, M.Sc., at Engineers' Club, Albert Square, Manchester, at 7 p.m.

West Riding of Yorkshire Branch:—"Oil-Engine Castings" (Third Series), Paper by H. E. Beardshaw, at the Technical College, Bradford, at 6.30 p.m.

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Dear Sirs,

In reply to your letter of the 13th.instant, we enclose herewith the two negatives of the Foundry Plant you recently installed for us.

We may say that the Plant continues to give satisfaction and we are obtaining the following output:-

Green Sand	-	25 cwts. per hour.
Facing Sand	-	25 " "
Oil Sand.	-	15 " "

The plant is well ahead of our requirements and is running daily.

Yours faithfully,
REAVELL & CO.LTD.

encl.2 negatives.

Raw Material Markets

A further increase in the output of iron and steel has been registered, but the demand for supplies remains in excess of the tonnage available. As a result, contracts for early delivery continue to be difficult to place. Little change in the present firm conditions of the market is likely to occur for some considerable time, as most of the works have sold their outputs over several months and any new material that becomes available will be taken up immediately. The question of prices remains in abeyance, but the general opinion is that increased values will rule in the near future.

Pig-Iron

MIDDLESBROUGH.—Deliveries under running contracts are belated and works are being hard pressed to keep them from falling further behind schedule. Small supplies of foundry iron are being obtained by consumers in this district from other areas, but these sources are not offering large tonnages. Producers are increasing their outputs in the Cleveland area, but it will be some months before deliveries are back to normal. Prices remain unchanged and purely nominal. No. 3 Cleveland G.M.B. is 70s. per ton delivered Middlesbrough or Falkirk, 72s. on the North-East Coast, and 73s. in Glasgow, with 1s. per ton discount for No. 4 foundry, and 2s. 6d. per ton extra for No. 1 foundry grade.

Producers of hematite on the North-East Coast have maintained deliveries according to their commitments, but any surplus material is quickly taken up by home consumers. Export business has been restricted to a few small parcels. Business is still being transacted at prices which are above the official minima, East Coast makers quoting 77s. per ton for No. 1 quality, delivered North-East Coast or Scotland, 82s. 6d. in Sheffield, and 87s. 6d. in Birmingham.

LANCASHIRE.—Several new contracts have been arranged recently, but makers are not guaranteeing that deliveries will be kept to schedule. Current deliveries into consumption continue to be satisfactory. Conditions among the machine-tool makers are more active and as a result the jobbing foundries are taking up larger tonnages of pig-iron. Heavy electrical concerns and the light-castings founders are also taking good quantities, but the textile machinists remain comparatively poorly employed. Prices are firm, with offers of Derbyshire, Staffordshire, and Lancashire brands of No. 3 foundry iron equal to Derbyshire all quoted for delivery to users in the Lancashire zone on the basis of 78s. per ton, Northamptonshire at 76s. 6d., and Derbyshire forge iron at 73s., with deliveries after the end of June at 5s. per ton extra in each case. Hematite is being well taken up, with offers of West Coast material on the basis of 85s. 6d. and of East Coast at from 84s. 6d. to 85s., with Scottish foundry iron quoted at around 87s. 6d. per ton, all delivered equal to Manchester.

MIDLANDS.—Prices remain unaltered, but owing to the extreme stringency of supplies, little business has been transacted. A premium of 5s. per ton is being charged for deliveries after June 30, and for deliveries before that date quotations are nominal at 72s. 6d. for Northants No. 3 and 75s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, delivered Birmingham and Black Country stations. A small sliding-scale rebate is allowed to large consumers. Special irons for use by the general engineering and jobbing foundries are well inquired for and prices are very firm. Medium-phosphorus irons are on offer at between 80s. and 87s. 6d., low-phosphorus 92s. 6d. to 100s., and special-quality low-carbon refined iron from £6 10s. to £7 15s. per ton, delivered this area. It continues to be difficult to obtain certain grades of hematite and some of the furnaces remain off the market. Quotations, inclusive of the recent premium, delivered to Midland stations, are £4 8s. 6d. for West Coast mixed numbers, £4 7s. 6d. for East Coast No. 3, and £4 7s. for Welsh mixed numbers, with 1s. 6d. per ton extra if delivered to works in 10-ton lots.

SCOTLAND.—Very active trading conditions continue to prevail in this area. Owing to the uncertainty concerning prices little new contract business has been arranged during the past week. Prices remain at 74s. f.o.t. furnaces for No. 3 foundry, with 2s. 6d. extra for No. 1. Supplies of Middlesbrough pig-iron are only coming into this area in very small tonnages and Falkirk and Glasgow users are having to take up considerable tonnages from the Midlands. The light-castings founders are very active and have excellent prospects. Quotations for No. 3 Cleveland iron remain unaltered at 70s. f.o.t. Falkirk, and 73s. f.o.t. Glasgow. Midland foundry iron is on offer at 1s. 3d. per ton below the foregoing figures. The steelworks' requirements are heavy and if it were possible they would be willing to buy forward. Prices are as follow:—Mixed numbers East Coast, West Coast, and Scottish hematite, 77s.; basic, British and Indian, 70s. (less 5s. rebate), all delivered f.o.t. steelworks.

Coke

Difficulty is being experienced at several ovens in satisfying the heavy demand for supplies of cupola coke. Prices have not eased for prompt delivery, or even for delivery during the summer months. For delivery in Birmingham and district best Durham coke is 41s. 6d. to 43s., while quotations for Welsh vary, according to quality and tonnage, from 38s. 6d. to 50s. per ton.

Steel

Busy conditions continue to rule in the steel market, and most of the steelworks are extending the periods in which they can promise the execution of orders, states the official report of the London Iron and Steel Exchange. The demand for semi-finished steel has been maintained, and consumers' requirements appear to be in excess of the industry's productive capacity. Fresh orders are difficult to place, and even the renewal of expiring contracts is not easily arranged. The manufacturers are committed for a long period ahead, and are assured of busy conditions for months to come. In the finished steel section of the market, new business has been rather quiet; but the producing works are operating practically at capacity and have a heavy tonnage of orders in hand. Export business is irregular, and, although inquiry has shown signs of expanding, business has been spasmodic.

Scrap

Very few new contracts have been arranged in the Cleveland scrap market during the past week owing to most merchants being fully sold. Supplies are moving more freely following the importation of large consignments from abroad. Heavy melting steel is at 57s. 6d. per ton, while 65s. has been paid for good machinery metal. Heavy foundry cast iron is quoted from 60s. to 62s. 6d. and clean light iron at 52s. 6d. Little change has occurred in the Midlands market during the past week, the demand for all qualities of scrap material being maintained on a good scale. Heavy, unsheared wrought iron is at 67s. 6d. to 72s. 6d., while heavy machinery metal in handy sizes is at 62s. 6d. to 65s., good heavy at 57s. 6d., and clean light metal at 52s. 6d. Short, heavy steel scrap, as used in the foundries, is at 65s. to 66s. per ton, delivered works. Values on the Scottish market remain unchanged, but very firm. Heavy mild-steel melting scrap is at 57s. 6d. per ton, with heavy basic, or heavy iron and steel scrap mixed, 5s. less. Good, clean, heavy machinery cast-iron scrap has a good demand at 70s. to 72s. 6d. Clean, ordinary, heavy cast iron is at 66s. to 67s. per ton, delivered f.o.t. consumers' works.

Metals

Copper.—Steady conditions have prevailed in this market during the week and buying reached fairly substantial proportions. Consumption in this country has been maintained on a good scale. In the United States the market has become firmer and the industrial outlook is viewed favourably. Discussing the February statistics, the weekly market report issued by Brandeis, Goldschmidt & Company, Limited, states that the figures "made a far better showing than those for January. Production in America was slightly greater than apparent consumption, but outside the United States there was a substantial improvement and on balance world stocks declined by about 7,000 tons, a considerable part of which was reflected in the figures for stocks in United Kingdom warehouses. It is expected that in the current month a further decline will be shown, but there is no doubt that there has been an increase in stocks at consumers' works in the United States and to a lesser extent elsewhere, due to the anticipatory purchases when some American producers tentatively raised the price to 9.50 cents."

Daily market prices:—

Cash.—Thursday, £36 to £36 1s. 3d.; Friday, £36 to £36 2s. 6d.; Monday, £36 2s. 6d. to £36 3s. 9d.; Tuesday, £36 to £36 1s. 3d.; Wednesday, £35 16s. 3d. to £35 17s. 6d.

Three Months.—Thursday, £36 7s. 6d. to £36 8s. 9d.; Friday, £36 7s. 6d. to £36 8s. 9d.; Monday, £36 8s. 9d. to £36 10s.; Tuesday, £36 7s. 6d. to £36 8s. 9d.; Wednesday, £36 3s. 9d. to £36 5s.

Tin.—Little of importance seems to have been decided at the meeting of the International Tin Committee held in London last week. Discussions were chiefly concerned with the renewal of the restriction scheme and not with the immediate consideration of quotas. Demand from consumers in this country remains moderate, but conditions on the Continent and in the United States have been subdued. Tin exports for the month of February were as follow:—Netherlands East Indies, 2,076 tons; Nigeria, 699; Bolivia, 1,694; Malaya, 4,754; and Siam, 977 tons.

Metal Exchange quotations were as follow:—

Cash.—Thursday, £215 to £215 10s.; Friday, £213 10s. to £214; Monday, £213 5s. to £213 15s.; Tuesday, £212 10s. to £213; Wednesday, £210 10s. to £211 10s.

Three Months.—Thursday, £206 to £206 5s.; Friday, £205 2s. 6d. to £205 5s.; Monday, £205 5s. to £205 15s.; Tuesday, £204 15s. to £205; Wednesday, £203 15s. to £204.

Spelter.—The general tone of this market remains unchanged and little business of importance has been transacted during the past week. Prices have been steady. It seems that little progress has been made towards the renewal of the International Zinc Cartel, although in Belgian zinc-producing circles prospects of a resuscitation of the Cartel are viewed quite hopefully. Fresh conversations are being held this week.

Official quotations were as follow:—

Ordinary.—Thursday, £16; Friday, £15 18s. 9d.; Monday, £16; Tuesday, £16; Wednesday, £16.

Lead.—Demand on industrial account for this metal is satisfactory, armament and building programmes being largely responsible. Trade with the building industry is now beginning to revive and the next few months should witness a heavy consumption from this source. Figures issued by the American Bureau of Metal Statistics show that stocks of refined lead at the end of February totalled 225,000 tons, compared with 224,000 tons at the end of January. Production during the month totalled 34,100 tons, against 36,300 tons.

Day-to-day quotations:—

Soft Foreign (Prompt).—Thursday, £16 17s. 6d.; Friday, £16 15s.; Monday, £16 12s. 6d.; Tuesday, £16 11s. 3d.; Wednesday, £16 10s.

IDAHO PINE
YELLOW PINE

PRIME & PATTERN GRADES
½" to 3" thick
Width up to 24" wide
All free of centre heart and shake

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YOU see there are many good Iron Founders in the Midlands, and in the South for that matter, who have a secret yearning to mould again with a genuine Scottish Rock Sand, such as perhaps they have once been used to. They like the heavy bond, the coarse grains, the high permeability . . . Others have never known such luxuries.

The trouble comes from not being able to move large chunks of mother-earth down South from the banks and braes without the penalty of spending a lot of money—a deplorable thought!

But the merrily tapping of wayside rocks with our little geological hammers and our love of digging holes have taken effect. We've discovered nature's bounty in a natural rock moulding sand within easy reach of *the Midlands*. (EUREKA!)

It is christened Tor Rock Sand, and we baptize it with just enough water in a painstaking mill to give a wonderfully plastic, coarse, cohesive sand—a moulder's delight.

The scientific fellows say it's like this:—

CHEMICAL ANALYSIS.

Silica	86·8 %
Ferric Oxide	1·43%
Alumina	7·6 %
Lime	·22%
Magnesia	·18%
Titanic Oxide	·18%
Alkalies	1·8 %
Loss on ignition	1·6 %

MECHANICAL ANALYSIS.

Very Coarse Sand (+ 1 mm) ..	16·5%
Coarse Sand (+·5 mm − 1 mm) ..	16·0%
Medium Sand (+ ·25 mm − ·5 mm)	11·0%
Fine Sand (+ ·1 mm − ·25 mm) ..	30·0%
Silt Grade (+ ·01 mm − ·1 mm) ..	7·0%
Clay Grade (− ·01 mm)	19·5%

which doesn't explain everything, but we will if you will write to us.

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RAW MATERIALS—PRICE LIST

(Wednesday, March 25, 1936)

COPPER

	£ s. d.
Standard cash	35 16 3
Three months	36 3 9
Electrolytic	40 2 6
Tough	38 15 0
Best selected	39 5 0
Sheets	68 0 0
India	50 0 0
Wire bars	40 15 0
Ingot bars	40 15 0
H.C. wire rods	44 5 0
Off. av. cash, Feb.	35 7 0
Do., 3 mths., Feb.	35 14 3¾
Do., Sttlmnt., Feb.	35 7 0
Do., Electro, Feb.	39 14 0
Do., B.S., Feb.	39 2 6
Do., wire bars, Feb.	39 18 9
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	6½d.

BRASS

Solid drawn tubes	9¾d.
Brazed tubes	11¼d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	8d.
Wire	7¾d.
Rolled metal	7¾d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£ s. d.
Standard cash	210 10 0
Three months	203 15 0
English	210 10 0
Bars	212 10 0
Straits	212 0 0
Australian	211 0 0
Eastern	208 10 0
Banca	212 0 0
Off. av. cash, Feb.	207 5 2¼
Do., 3 mths., Feb.	200 7 9
Do., Sttlmt., Feb.	207 5 3

SPELTER

	£ s. d.
Ordinary	16 0 0
Remelted	13 10 0
Hard	12 5 0
Electro 99.9	18 2 6
English	16 17 6
India	13 10 0
Zinc dust	19 10 0
Zinc ashes	4 5 0
Off. aver., Feb.	15 5 1⅞
Aver. spot, Feb.	15 2 6

LEAD

	£ s. d.
Soft foreign ppt.	16 10 0
Empire (nom.)	17 6 3
English	18 10 0
Off. average, Feb.	16 1 7½
Average spot, Feb.	16 0 5¾

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	23 17 6
Do., V.M. ex-whse.	25 5 0
Rods	28 0 0

ANTIMONY

	£ s. d.
English	72 0 0 to 73 0 0
Chinese, ex-whse.	61 0 0
Crude, c.i.f.	31 0 0

QUICKSILVER

	£ s. d.
Quicksilver	12 0 0 to 12 11 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£21 0 0 to £22 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 15 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	33 0 0
Max. 1% car.	36 5 0
Max. 0.70% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/5 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£11 5 0 to 11 15 0
76/80% packed	£12 5 0 to 12 15 0
76/80% export	(nom.) £10 5 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	3 5 0	to 3 6 0
Mixed iron and steel	3 0 0	to 3 2 0
Heavy cast iron	2 17 6	to 3 0 0
Good machinery	3 2 6	to 3 5 0
Cleveland—		
Heavy steel	2 17 6	
Steel turnings	2 0 0	
Heavy cast iron	3 0 0	to 3 2 6
Heavy machinery	3 3 6	to 3 5 0
Midlands—		
Light cast-iron scrap	2 12 6	
Heavy wrought iron	3 7 6	to 3 12 6
Steel turnings	2 2 6	
Scotland—		
Heavy steel	2 17 6	
Ordinary cast iron	3 6 0	to 3 7 0
Engineers' turnings	2 2 6	
Cast-iron borings	1 17 6	to 1 18 9
Wrot-iron piling	3 8 9	to 3 11 3
Heavy machinery	3 10 0	to 3 12 6

London—Merchants' buying prices, delivered yard.

Copper (clean)	29 0 0
Brass	19 10 0
Lead (less usual draft)	15 5 0
Tea lead	10 10 0
Zinc	8 10 0
New aluminium cuttings	74 0 0
Braziery copper	27 0 0
Gunmetal	27 0 0
Hollow pewter	155 0 0
Shaped black pewter	120 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	72/6
,, No. 3	70/-
,, at Falkirk	70/-
,, at Glasgow	73/-
,, No. 4	69/-
Forge No. 4	69/-
Hematite No. 1	77/-
Hematite M/Nos.	76/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	77/-
,, d/d Birm.	88/6
Malleable iron d/d Birm.	119/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	71/-
,, No. 3 fdry.	75/-
Northants forge	68/6
,, fdry. No. 3	72/6
,, fdry. No. 1	75/6
Derbyshire forge	71/-
,, fdry. No. 3	75/-
,, fdry. No. 1	78/-
Scotland—	
Foundry, No. 1, f.o.t.	76/6
,, No. 3, f.o.t.	74/-
Hem. M/Nos. d/d	77/-
Sheffield (d/d district)—	
Derby forge	68/6
,, fdry. No. 3	72/6
Lincs forge	68/6
,, fdry. No. 3	72/6
W.C. hematite	90/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	78/-
Staffs fdry. No. 3	78/-
Northants fdry. No. 3	76/6
Cleveland fdry. No. 3	78/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/6
Clyde, No. 3	87/6
Monkland, No. 3	87/6
Summerlee, No. 3	87/6
Eglinton, No. 3	87/6
Gartaherrie, No. 3	87/6
Shotts, No. 3	87/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	10 2 6	
Nut and bolt iron	8 10 0	to 9 0 0
Hoops	11 0 0	and up.
Marked bars (Staffs) f.o.t.	12 10 0	
Gas strip	11 0 0	and up.
Bolts and nuts, ¾ in. × 4 in.	15 15 0	and up.
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	9 5 0	to 9 7 6
Chequer plts.	10 7 6	
Angles	8 7 6	
Tees	9 7 6	
Joists	8 15 0	
Rounds and squares, 3 in. to 5½ in.	9 7 6	
Rounds under 3 in. to ⅝ in. (Untested)	9 1 0	
Flats—8 in. wide and over	8 12 6	
,, under 8 in. and over 5 in.	8 17 6	
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 10 0	
Hoops (Staffs)	9 16 0	
Black sheets, 24g. (4-t. lots)	11 10 0	
Galv. cor. shts. (,,)	13 10 0	
Galv. flat shts. (,,)	14 0 0	
Galv. fencing wire, 8g. plain	15 0 0	
Billets, soft	5 17 6	and up.
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 15 0	to 6 0 0
Tin bars	5 15 0	to 6 0 0

PHOSPHOR BRONZE

	Per lb. basis
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11½d.
Tubes	14d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	21.31
No. 2 foundry, Valley	19.50
No. 2 foundry, Birm.	15.50
Basic, Valley	19.00
Malleable, Valley	19.50
Grey forge, Valley	19.00
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	36.37½
Billets	28.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.85
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.10
Plain wire	2.30
Barbed wire, galv.	2.50
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	20/- to 21/-
Durham foundry	23/6 to 24/6
,, furnace	21/-
Scotland, foundry	30/-
,, furnace	25/- to 26/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/9
,,	28×20 ,,	37/6
,,	20×10 ,,	27/-
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	15/9 to 16/3
,,	28×20 ,,	34/6
,,	20×10 ,,	23/- to 23/3
,,	18¾×14 ,,	16/-

SWEDISH CHARCOAL IRON & STEEL

	£ s. d.	£ s. d.
Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£	s.	d.		
Mar. 19 ..	36	0	0	No	change
„ 20 ..	36	0	0	„	„
„ 23 ..	36	2	6	inc.	2/6
„ 24 ..	36	0	0	dec.	2/6
„ 25 ..	35	16	3	„	3/9

Electrolytic Copper

	£	s.	d.		
Mar. 19 ..	40	5	0	inc.	2/6
„ 20 ..	40	5	0	No	change
„ 23 ..	40	5	0	„	„
„ 24 ..	40	5	0	„	„
„ 25 ..	40	2	6	dec.	2/6

Standard Tin (cash)

	£	s.	d.		
Mar. 19 ..	215	0	0	dec.	10/-
„ 20 ..	213	10	0	„	30/-
„ 23 ..	213	5	0	„	5/-
„ 24 ..	212	10	0	„	15/-
„ 25 ..	210	10	0	„	40/-

Tin (English ingots)

	£	s.	d.		
Mar. 19 ..	215	5	0	dec.	10/-
„ 20 ..	213	10	0	„	35/-
„ 23 ..	213	10	0	No	change
„ 24 ..	212	15	0	dec.	15/-
„ 25 ..	210	10	0	„	45/-

Spelter (ordinary)

	£	s.	d.		
Mar. 19 ..	16	0	0	inc.	1/3
„ 20 ..	15	18	9	dec.	1/3
„ 23 ..	16	0	0	inc.	1/3
„ 24 ..	16	0	0	No	change
„ 25 ..	16	0	0	„	„

Spelter (Electro, 99.9 per cent.)

	£	s.	d.		
Mar. 19 ..	18	1	3	inc.	1/3
„ 20 ..	18	0	0	dec.	1/3
„ 23 ..	18	2	6	inc.	2/6
„ 24 ..	18	2	6	No	change
„ 25 ..	18	2	6	„	„

Zinc Sheets (English)

	£	s.	d.		
Mar. 19 ..	23	15	0	No	change
„ 20 ..	23	15	0	„	„
„ 23 ..	23	17	6	inc.	2/6
„ 24 ..	23	17	6	No	change
„ 25 ..	23	17	6	„	„

Lead (English)

	£	s.	d.		
Mar. 19 ..	19	0	0	No	change
„ 20 ..	18	15	0	dec.	5/-
„ 23 ..	18	15	0	No	change
„ 24 ..	18	10	0	dec.	5/-
„ 25 ..	18	10	0	No	change

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in February, 1936, compared with February, 1935.

	February.		Two Months.		February.		Two Months.	
	1935.	1936.	1935.	1936.	1935.	1936.	1935.	1936.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron—from British India	7,448	7,444	12,515	11,707	21,605	22,969	36,551	35,931
„ Foreign Countries	329	2,198	2,690	4,611	2,010	12,907	16,690	25,075
Total	7,777	9,642	15,205	16,318	23,615	35,876	53,241	61,006
Castings and forgings	184	711	452	1,284	6,817	21,602	13,951	41,099
Cast pipes and fittings	60	140	119	233	2,858	4,409	5,853	6,599
Stoves, grates, etc.	69	51	159	101	6,464	8,001	12,637	13,216
Baths	507	826	953	1,499	14,563	16,423	27,097	37,248
Hollow-ware, all kinds	175	297	337	600	54,410	72,394	21,330	32,350
Exports.								
Pig-iron, forge and foundry	7,393	4,357	13,740	8,485	24,205	15,918	46,271	31,818
„ acid	1,773	2,328	6,651	4,912	5,587	7,621	21,134	16,350
„ basic	203	—	203	28	599	—	599	112
Total	9,369	6,685	20,594	13,425	30,391	23,539	68,004	48,280
Castings and forgings	297	324	741	684	11,424	13,296	28,027	25,919
Cast pipes and fittings, up to 6 in. diameter	4,184	3,950	8,971	8,322	45,801	47,614	97,546	96,034
„ „ „ over 6 in.	3,121	3,423	6,859	7,931	27,203	24,410	53,833	66,964
Stoves, grates, etc.	626	1,035	1,423	1,922	30,905	47,358	69,243	92,242
Sanitary cisterns	285	263	601	509	7,943	8,289	16,463	16,078
Bedsteads, inc. tubes therefor	357	450	698	852	13,077	15,935	25,860	31,152
Cast hollow-ware	306	444	609	853	10,777	14,875	22,797	29,274

WILLIAM JACKS & COMPANY,
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG REGISTERED TRADE MARK LUMPEY IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.
ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

ASSISTANT Foundry Cost Accountant. Position required with good prospects. Age 22. Passed Intermediate and studying Final Examination, Institute of Cost and Works Accountants. Two years' experience in foundry general office work. Special study of foundry costing.—Write Box 650, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Metallurgist, young, keen and energetic; good experience malleable, grey and aluminium; accustomed to control; desires change. Assistant foundry manager or would take charge of small malleable foundry.—Box 648, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST, age 37, first-class training and experience in steel and iron foundry work; special alloyed steels and iron manufactured by the high-frequency induction, electric-arc and Bessemer furnaces; analysis, metallography, heat-treatment; up-to-date mass-production methods; 12 years' Continental experience and organisation; fluent French; requires post with scope for advancement.—Box 654, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WORKS Chemist and Metallurgist, age 26, wishes situation. Eleven years' lab. exp.; used to mixing irons for various castings and cupola control.—Box 656, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ASSISTANT Foundry Manager with practical moulding experience, required for steel and iron foundry in North of England. Excellent opportunities for suitable man. Write stating age, experience, and salary required, to Box "B," KIDD'S ADVERTISING AGENCY, Publicity House, Middlesbrough.

FOUNDRY Foreman for non-ferrous foundry on N.E. Coast; 6 tons per week. Applicant must have experience in control of men, knowledge of metal mixtures and be conversant with modern methods, including production on moulding machines. State details of experience, firms worked for, age and salary.—Box 652, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

REPRESENTATIVE required for sale of blackings and plumbago. Extra. Must have good foundry connection. Practical experience of the foundry trade essential.—Box 646, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

AGENCY

AGENT Engineer with sound connection amongst South Wales foundries, steelworks, engineers, etc., has ample scope for handling additional Agencies for plant and accessories, pig-iron, scrap, refractories, etc.—Box 640, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATENT

THE Proprietors of Patent No. 394,699 for "A Process of Manufacture of Hollow Objects from Large Ingots" are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to: HASELTINE, LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

TENDER

METROPOLITAN WATER BOARD.

TENDERS FOR THE SUPPLY OF STORES, ETC.

THE Metropolitan Water Board invite Tenders for the supply of the undermentioned Stores and Services, etc., for the period of twelve months commencing June 1, 1936.

Contract No.

1.—Bricks, firebricks, cement, etc.
8.—Iron and steel.
9.—Bolts and nuts, screws, files, shovels, steam tubes, etc.
12.—Fuel oil, oil (lubricating), kerosene, motor spirit, greases, etc.
19.—Iron, brass, gunmetal and other castings.
20.—G.M. stopcocks and ferrules, outlets and caps for fire hydrants.
22.—Timber (hardwoods).
23.—Maintenance of weighing machines.

Tenders must be submitted on the official forms which may be obtained on and after Monday, April 6, 1936, from the Chief Engineer, by personal application at the offices of the Board (Room 171) or upon forwarding a stamped addressed envelope (large).

Applicants should refer to the number of the Tender for which forms are required.

Tenders, enclosed in sealed envelopes, addressed to "The Clerk of the Board" and endorsed in the manner indicated in the Form of Tender, must be delivered at the offices of the Board (Room 122) not later than 11 a.m. on Monday, April 20, 1936.

The Board do not bind themselves to accept the lowest or any Tender.

G. F. STRINGER,
Clerk of the Board.

Offices of the Board,
173, Rosebery Avenue, E.C.1.
March 23, 1936.

MACHINERY

FOR SALE.—Foundry Ladles for Steel Casting. Two 3 tons; one 4 tons. Also Ladle Truck.—Apply E. HIND, Imperial Works, South Bank-on-Tees

Tilghman Sandblast Barrel Plants; barrel sizes—60 in. x 40 in.; 36 in. x 20 in.; 20 in. x 30 in.

Tilghman Sandblast Cabinet Plants; 4 ft. 6 in. and 3 ft. 6 in. square (one for high pressure 70 lbs. per sq. in.); also small Cabinet 30 in. dia.

All complete with Air Compressors, etc.

Pneulec Royer Sand Thrower, size No. 1.

Six Osborne Pneumatic Jolt Press Moulding Machines, size 75J.

Three Mumford Yoke Headpress Pneumatic Moulding Machines.

Two Herbert Whizzer Sand Disintegrators.

Two Brealey Type ditto.

Heavy Double-ended Grinding Machines by Rowlands, Luke & Spencer, etc.

Hand Moulding Machines by Adaptable Darling & Sellars, Pridmore, Samuelson, etc.

500 Electric Motors, Dynamos, Rotary Converters, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.

CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.

'Phone: Broadwell 1359.

THOS. W. WARD LTD.

New Pneumatic SAND-MOULDING MACHINE; admits pattern boxes 16" x 16" x 16"; air pressure 80/100 lbs. per sq. in.

Inclining TUMBLING BARREL (Canning); 22" dia. barrel x 18" deep; 50 r.p.m.; 12" dia. F. & L. pulleys.

Five Steel ROLLER DOORS; 18' x 20' high x 10'/11' 6" wide; complete with winding gear.

Five Nissen-type STEEL BUILDINGS; 550' x 40' x 19' 10" high.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued*

SECOND-HAND Foundry Cupola, 4 ft. 6 in. dia., 5-6 tons per hr., complete with motor-driven fan; motor 400 volts, 3-phase, 50 cycles, and pipes. Cheap to quick buyer.—E. A. ROPER & Co., Airedale Buildings, North Street, Keighley.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

FOR SALE.—Three "Ajax" No. 9 Turnover Moulding Machines and one "Ajax" Stripping-Plate Moulding Machine with vibrator, complete with all accessories. Can be seen under working conditions. Price £50 each.—THOMAS BROADBENT & SONS, LIMITED, Huddersfield.

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. A new edition now ready. Price 42s. cloth bound, 52s. Morocco. Order your copy now.——INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2.

'Phone: 287 SLOUGH

MOULDING MACHINES

Three jolt roll-over Britannia Machines, as new. Cheap.
Eight No. 1 Britannia Jolters. Price **£26 each.**
Modern Tabor Squeeze Roll-over Machine. Price **£75.**
Osborn Hand Roll-over Machine. Price **£28.**
Six Denbigh Hand Jolters, various sizes.

CUPOLAS

4' 6" dia. shell Davies Cupola, with A.C. Fan. NEW.
30" dia. Cupola in new condition, complete. **£38.**
30" dia. New Cupolette complete with fan, **£30.**

TILTING FURNACES—Oil and Coke Fired.

AIR COMPRESSORS—All sizes.

PLEASE SEND US YOUR ENQUIRIES.

ALEX. HAMMOND, *Foundry Machinery Merchant,*
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BUY FROM ME AND SAVE MONEY!

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MOULDING MACHINES IN THE WORLD

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